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HAYWARD (K. J.). **El " carbón " de la caña y los insectos.** [The Smut of Sugar-cane and Insects.]—*Circ. Estac. exp. agríc. Tucumán* no. 123, 1 p. Tucumán, 1943.

In Tucumán, Argentina, insects often occur on sugar-cane shoots attacked by smut (*Ustilago scitaminea*). The adults of *Phalacrus* sp. feed on the spores and oviposit on the infested shoots, in which the larvae develop. The Anthribid, *Brachytarsus zeae*, Wolfrum, also feeds on the fungus, as probably does the Anthicid, *Anthicus albifasciatus*, Pic. Though these and other insects may occasionally carry the spores from plant to plant, such carriage is of no importance as the spores are much more extensively distributed by wind.

BEAMER (R. H.). **A new *Atanus* from Argentina, South America (Homoptera-Cicadellidae).**—*Proc. ent. Soc. Wash.* **45** no. 7 p. 178, 4 figs. Washington, D.C., 1943.

The Jassid, *Atanus exitiosus*, sp. n., is described from adults of both sexes taken on sugar-beet in the Rio Negro valley, Argentina, in 1941. It is suspected of transmitting a virus disease of sugar-beet in South America.

SANTORO DE CROUZEL (I.) & SALAVIN (R. G.). **Contribución al estudio de los *Neorhynchocephalus* argentinos (Diptera ; Nemestrinidae).** [A Contribution to the Study of Argentine *Neorhynchocephalus*.]—*An. Soc. cient. argent.* **136** pt. 4 pp. 145–172, 4 pls., 10 refs. Buenos Aires, 1943.

Adults of the grasshoppers, *Trigonophymus* (*Dichroplus*) *arrogans*, Stål, and *T.* (*D.*) *elongatus*, Giglio-Tos, in Argentina were found on several occasions to be infested with larvae of the Nemestrinid, *Neorhynchocephalus sulphureus*, Wied., and *T. elongatus* by those of *N. vitripennis*, Wied. Detailed descriptions are given of all stages of *N. sulphureus*. The adults frequent flowers, but it was impossible to keep them alive in captivity for more than 76 hours. Although the method of attack was not observed, it appears that the female probably attacks the host while in flight, pierces its integument with its ovipositor and lays an egg beneath the surface. The larval stage lasted over a month and comprises four instars, in each of which the larva possesses a respiratory tube opening through the integument of the host. Not more than one larva was found in a host, and it feeds on blood and fat tissue without causing injury to any vital organs. The hosts died soon after the full-fed larvae left them, and the larvae then burrowed into the soil but remained in a prepupal stage for from 43 to 1,011 days. The pupal stage lasted not more than 30 days. Observations on *N. vitripennis* were less complete, but indicated that its life-cycle is similar.

HANDFORD (R. H.). **Progress Report on Grasshopper Bait Investigations, Canadian Prairies, 1943.**—[*Leafl.*] *Brandon Lab. Dep. Agric. Canada* no. 18, 14 pp., multigraph, 4 refs. Brandon, Man., 1944.

This is a report on further tests of grasshopper baits [*cf. R.A.E.*, A **30** 493; **31** 308] carried out against *Melanoplus bivittatus*, Say, in Manitoba, and *M. mexicanus*, Sauss., in Saskatchewan.

When tested under varying conditions of weather and vegetation, sodium arsenite appeared to be a more reliable poison than either sodium fluosilicate or calcium arsenite, especially when the carrier was sawdust alone or sawdust mixed with flour. Sodium fluosilicate gave satisfactory kills at dosages of over 3 lb. per 5¼ bushels carrier (equivalent in volume to 100 lb. bran), 4 lb. being the dosage recommended for practical use. Calcium arsenite was rather less effective than sodium arsenite when the arsenic content of the bait was practically the same. Of the carriers, a mixture of bran and sawdust (1 : 1) proved

to be reliable under a greater variety of conditions than baits of 1 part flour in 13, 27 or 55 parts sawdust, 1 part shorts in 13 parts sawdust or sawdust alone. It is suggested that bran baits should be used in wet seasons, or in heavy vegetation on irrigated lands, especially in the case of *M. bivittatus*. The sawdust baits containing the different proportions of flour did not appear to differ in effectiveness, but more work with different types of sawdust is required before these results are accepted, since some types are not made more attractive by the addition of flour. The best appears to be fine-particled sawdust either considerably weathered or cut from thoroughly seasoned wood. Shorts and sawdust in the only proportion tested (1 : 13) was not significantly inferior to flour and sawdust in the same proportion. Molasses did not increase the efficiency of flour-sawdust-fluosilicate bait, but fermented molasses might have given better results. Baits applied at different times of the day were almost equally effective, and there is apparently no need to wait before applying the bait until the minimum feeding temperature (68°F.) is reached. The efficiency of baits in general was found to decrease with an increase in density of the vegetation, but this is considered to be associated more directly with the amount of sunshine reaching the soil surface than with the availability of suitable food.

BALCH (R. E.) & HAWBOLDT (L. S.). **Report on Forest Insects in New Brunswick, 1942.**—*106th Rep. Dep. Lds Min. New Brunsw. 1941–42* pp. 116–118. Fredericton, N.B., 1943.

Populations of the European spruce sawfly [*Gilpinia hercyniae*, Htg.] continued to decrease in New Brunswick in 1942 [*cf. R.A.E.*, A **30** 465 ; **32** 22] ; only two cases of severe infestation were recorded, and, in general, attack was light. Mortality due to the disease of the larvae has increased in importance during the past three years, and was the principal factor involved in 1942. It was established in new areas by means of an extract of diseased larvae. Parasites of *G. hercyniae* released during the year comprised 1,900,000 examples of *Microplectron fuscipenne*, Zett., including 480,000 from a stock bred selectively for preference for low temperatures [**30** 606], 2,212 of *Exenterus amictorius*, Panz. (*marginatorius*, F.), 1,137 of *E. claripennis*, Thoms., and 6,058 of *Sturmia* sp., which attacks many species of sawfly. Dieback of birch due to attack by the bronze birch borer [*Agrilus anxius*, Gory] continued in mature stands throughout most of the Province and extended into Quebec, Nova Scotia [**32** 110] and Maine. Over 25 per cent. of the trees were reported to be dead or dying [*cf.* **29** 347], and mortality was highest in the central southern part of the Province, where the injury first appeared. Farther north, the loss in merchantable volume of veneer or lumber was considerably below 10 per cent., but is likely to increase, and if the present level of infestation is maintained is expected to reach 20–50 per cent. within three or four years. The felling of yellow birch [*Betula lutea*] in affected areas is recommended in view of the demand for veneer and birch lumber ; as a protective measure for the remaining or succeeding stock, no mature or decadent trees should be left standing. Where trees are felled for fuel, mature ones, especially those showing injury, should be removed first.

Other insects reported during the year include the balsam woolly aphis [*Chermes piceae*, Ratz.], local outbreaks of which caused some mortality, on account of which early felling for salvage or control is recommended ; the larch case-bearer [*Coleophora laricella*, Hb.], which caused considerable bronzing of the early foliage of larch in the south ; *Fenusa pusilla*, Lep. (*pumila*, Klug), which caused browning of the foliage of grey and white birch [*Betula populifolia* and *B. papyrifera*] ; *Bucculatrix canadensisella*, Chamb., which was numerous on all species of birch and destroyed most of the foliage in some stands ; *Phyllotoma nemorata*, Fall., which was fairly common on birch, and *Cryptococcus fagi*, Baer., which extended its range on beech and occurred in heavy infestation

almost as far as the north coast. The introduced parasite, *Mesoleius tenthredinis*, Morl., of the larch sawfly [*Pristiphora erichsoni*, Htg.], outbreaks of which have almost disappeared, was collected during the year for redistribution. An outbreak of *Chermes* (*Pineus*) *pinifoliae*, Fitch, on white pine [*Pinus strobus*], which has been in progress for three or four years [*cf.* **32** 110], caused injury over an area of about 100 square miles and killed many shoots of the previous year, particularly on immature trees. A few of the weaker trees were destroyed, but the outbreak appears to be decreasing and no serious effects are expected.

Heriot (A. D.). **How does Lead Arsenate prevent the young Codling Moth Larva from injuring the Fruit ?**—*Proc. ent. Soc. B.C.* **40** pp. 3–8, 1 pl. Vernon, B.C., 1943.

Since sprays of lead arsenate frequently give poor control of the codling moth [*Cydia pomonella*, L.] in the arid and semi-arid apple-growing areas of western North America despite thorough application, laboratory investigations were carried out in British Columbia to ascertain how and when the action of lead arsenate takes place. The following is based on the author's summary. Several ways in which a residue of lead arsenate may prevent the young larvae from injuring fruit are discussed. Certain types of residue involving oils have been shown to influence control by their physical and mechanical characteristics alone, but the effectiveness of the residue from a spray of lead arsenate, casein and lime may be due chiefly to its repellent qualities. These are indicated by the reluctance of the larvae to attack sprayed leaves and fruit and appear to exert most influence when the larva is removing the cuticle of the fruit before starting to feed. Owing in part to the structure of the labrum, the processes involved in the biting off and rejection of the sprayed particles of the cuticle may result in the retention of some of the residue in the pre-oral cavity, where the strongly alkaline fluids present are believed to react quickly with acid lead arsenate, causing the liberation of soluble arsenic. When the latter comes into contact with sensoria situated on the epipharynx, an avoidance reaction may be at once initiated. Direct toxic action by ingestion appears to be the exception rather than the rule, and experiments indicate that it is doubtful whether the processes incident to systemic poisoning can take place quickly enough to protect the fruit from serious blemishes. The residue from the spray of lead arsenate, casein and lime in general use appears to become progressively less effective as a repellent as the larval populations in an orchard increase, and this is attributed to the demonstrated ability of the larvae to discover and take advantage of previously attempted entries.

Hoy (B.). **Phenothiazine as a Codling Moth Insecticide.**—*Proc. ent. Soc. B.C.* **40** pp. 11–12. Vernon, B.C., 1943.

Sprays of phenothiazine against the codling moth [*Cydia pomonella*, L.] on apple were tested in orchards in British Columbia during 1937–38 and 1941–42. In preliminary tests in 1937, a proprietary preparation of phenothiazine stated to contain a wetting agent and used at the rate of 2 or 3 lb. per 100 gals. was less effective than lead arsenate at the rate of 3·2 lb. per 100 gals. with the addition of 4 oz. of a proprietary spreader (Fluxit) containing casein and hydrated lime, but in the following year, when both materials were used at 3¾ lb. per 100 gals., schedules of five cover sprays of lead arsenate and three of lead arsenate followed by two of phenothiazine resulted in 2·2 and 2·4 per cent. infested fruits, respectively, and 6·3 and 3 per cent. superficially injured fruits. In 1941, three sprays of only 1·8 lb. micronised phenothiazine per 100 gals., with 8 oz. monoethanolamine oleate and ½ gal. stove oil, following three of 3·3 lb. lead arsenate and 0·2 lb. Fluxit in 100 gals. were as effective as four applications of the lead-arsenate spray followed by two of 3¾ lb. Alorco synthetic cryolite and 0·2 lb. Fluxit in

100 gals., and in 1942 the micronised phenothiazine spray applied throughout the season following a calyx spray of lead arsenate resulted in only 1·4 and 0·9 per cent. infested and superficially damaged fruits, respectively, whereas the corresponding percentages for the schedule of lead arsenate and cryolite were 3·5 and 1·8. In order to prevent heavy flocculation of the phenothiazine in the spray tank, which occurred in 1941 and made application difficult, casein and hydrated lime at rates of ½ oz. and 4 oz. per 100 gals., respectively, were added to the final spray in that year and to all sprays in 1942; this gave a heavy uniform deposit, to which the improved control in 1942 is attributed. Fruit treated with phenothiazine was slightly superior in size and colour to that treated with lead arsenate, but a disadvantage in the use of this material was that it had an irritant effect on the skin of some of those engaged in thinning the crop.

ANDISON (H.) & EVANS (H. H.). **Prevention of Fruit Development and its Effect on the Survival of the Codling Moth.**—*Proc. ent. Soc. B.C.* **40** pp. 12–16, 18 refs. Vernon, B.C., 1943.

In recent years, attention has been paid to the possibility of destroying the flowers of apple trees by chemical sprays in order to eliminate part of the crop and so overcome the alternate bearing habit or to thin the crop. As it is likely that the early removal of the crop would reduce populations of the codling moth [*Cydia pomonella*, L.] to a low level, the value of the measure against the moth was investigated in British Columbia in 1941–42 in an orchard about 300 yards away from any others. Its success appears to depend on whether some individuals pass two winters in the larval stage before completing their development and the ability of the species to continue its existence in the absence of fruit; a review of the literature shows that neither point has been conclusively proved.

The following is taken from the authors' summary. So far no chemical has been shown to be capable of completely destroying the flowers without the likelihood of serious injury to the fruit spurs. Destroying the flowers of apple trees of three varieties by means of a 2 per cent. emulsion of a high-boiling tar oil, with sulphite lye (lignin pitch) as the emulsifier, and the subsequent removal of any fruit that developed did not prevent heavy infestation by *C. pomonella* in the following year in a two-generation area of the Okanagan Valley.

MARSHALL (J.). **Cryolite versus Lead Arsenate for Control of Codling Moth.**—*Proc. ent. Soc. B.C.* **40** pp. 16–18, 3 refs. Vernon, B.C., 1943.

Cryolite was recommended in 1939 for late sprays against the codling moth [*Cydia pomonella*, L.] on apple in the interior of British Columbia, and unsatisfactory control obtained by some growers since then has been attributed to its use. The results of experiments with it under arid and semi-arid conditions in Washington between 1928 and 1938 and British Columbia between 1936 and 1942 are therefore summarised. In Washington, sprays containing cryolite and lead arsenate gave approximately equal control in four years, cryolite was superior in two and lead arsenate in one, the differences being comparable with those obtained in different plots sprayed with the same material. In British Columbia, the percentages of infested fruit from plots sprayed with lead arsenate and cryolite averaged 5·7 and 6·1, respectively, in 14 trials in 1936–42, and trees sprayed throughout the season with a mixture of cryolite, casein and lime were no more heavily infested at the end of three years than those in adjacent plots that had been sprayed throughout with lead arsenate, casein and lime. In comparative tests in 1940–42, natural and synthetic cryolite proved equally satisfactory, the percentage fruit infestation in the plots averaging 6·1 and 7·0, respectively, in nine experiments.

BUCKELL (E. R.). **The Weevil *Auletobius congruus* (Walker) a Pest of Strawberries.**—*Proc. ent. Soc. B.C.* **40** p. 23. Vernon, B.C., 1943.

In May 1940, serious local damage to strawberry flowers by adults of *Auletobius congruus*, Wlk., was observed in eastern British Columbia. On 18th May, it extended over about 4 acres and 35 per cent. of the flowers were destroyed over ½ acre. The weevils bit into the base of the flowers, causing them to wilt and die. They had not previously been noticed on the plants and have not appeared on them since, and the species does not appear to have been previously recorded as a pest of strawberry. The adults have been observed feeding on a wild species of *Ranunculus* farther south in the Province.

HARDY (G. A.). **Field Observations on the Forest Tent Caterpillar, *Malacosoma disstria* var. *erosa* Stretch.**—*Proc. ent. Soc. B.C.* **40** pp. 28–29. Vernon, B.C., 1943.

An extremely heavy outbreak of *Malacosoma disstria* var. *erosa*, Stretch, occurred over an estimated area of 50 square miles in eastern British Columbia in 1942. Nearly all the aspen trees (*Populus tremuloides*) were defoliated by the larvae, which also fed on willow, alder, birch, dogwood [*Cornus*] and rose; cocoons were also formed on many other plants, on which the larvae did not feed. An even heavier outbreak was stated to have occurred in the previous year. By 24th June 1942, the larvae were nearly full-grown, and at the beginning of July large numbers of birds were feeding on large yellow Dipterous larvae that fell from the cocoons in order to enter the soil for pupation. Of a collection of 100 cocoons of *M. disstria*, 44 contained larvae, each parasitised by 1–5 Dipterous larvae, 26 contained parasitised pupae and 30 contained pupae that were not parasitised but varied considerably in vigour.

MOORE (H. W.). **A mechanical Aspirator for sorting and counting Insects in the Field.**—*Canad. Ent.* **75** no. 9 p. 162, 1 ref. Guelph, Ont., 1943.

A description is given of an aspirator for transferring grasshoppers from collection to field cages; it is operated by a vacuum created in the intake manifold of a car engine. It has been in use in Manitoba and Saskatchewan since 1940, and enables three men to handle 1,000 grasshoppers per hour.

CUSHMAN (R. A.). **Further Notes on *Exenterus* (Hymenoptera, Ichneumonidae).**—*Canad. Ent.* **75** no. 9 pp. 169–174, 3 figs. Guelph, Ont., 1943.

Descriptions are given of both sexes of *Exenterus walleyi*, sp. n., reared from *Neodiprion nanulus*, Schedl, and *N. abietis*, Harr., in Ontario and also recorded in New Brunswick, and of the female of *E. platypes*, sp. n., reared from *N. banksianae*, Rohw., in Minnesota and Ontario and from an unidentified pine sawfly in North Carolina, and part of the author's key to the genus [*R.A.E.*, A **29** 293] is amended to include them. He considers *E. flavissimus*, Cushm. [**29** 294] to be identical with *E. canadensis*, Prov., on the basis of specimens showing intermediate characters, and proposes that *E.* (*Ichneumon*) *marginatorius*, F., should be designated *E.* (*I.*) *amictorius*, Panz. (the next available name), since the former is preoccupied by *I. marginatorius*, Rossi.

KNOWLES (R. P.). **The Role of Insects, Weather Conditions, and Plant Character in Seed Setting of Alfalfa.**—*Sci. Agric.* **24** no. 1 pp. 29–50, 4 figs., 15 refs. Ottawa, 1943.

Since 1932, the production of lucerne seed has been an important industry in northern Saskatchewan, but the crop has failed several times, partly because of poor seed setting, and the investigations described were carried out in 1939–42 to determine the factors influencing the production of seed.

The following is largely based on the author's summary. The production of seed by plants enclosed in screen cages was severely reduced as a result of decreased tripping and inferior pod setting and filling, and caging was detrimental to seed setting through the exclusion of insects that trip and cross-pollinate the flowers, rather than through changes in temperature, humidity and light intensity. The amounts of tripping and of seed setting and the abundance of leaf-cutting bees of the genus *Megachile* were shown to be significantly correlated in 116 lucerne fields in one area in 1941 and 1942. These bees fluctuated widely in numbers during the flowering season ; they were less abundant than honey-bees, which, however, were unable to trip lucerne flowers, but more so than bumble-bees. *M. vidua*, Smith, was the commonest species collected in the fields, and nests of *Megachile* were found in logs and stumps of balsam poplar [*Populus balsamifera*] on uncleared land adjoining them. Leaf-cutting bees visited an average of 17·3 flowers a minute and tripped nearly all of them. An average of 2·55 seeds developed in the flowers tripped by this means, whereas the number that developed in flowers tripped by hand averaged only 0·42. Temperature was the most important of the weather conditions influencing tripping, and most flowers on uncaged plants were tripped between 8 a.m. and 4 p.m. Plants that were not visited by insects occasionally set seed well owing to a high degree of automatic tripping and partial self-fertility. Selected self-fertile flowers and flowers on plants selected at random set averages of 1·65 and 0·56 seeds per pod, respectively, when they were self-pollinated, and 4·6 and 3·7 when they were cross-pollinated. Cross-pollination occurred in an average of 94·2 per cent. of the flowers. Factors other than the abundance of wild bees present may influence seed-setting ; these include attack by *Lygus*, since high populations of this Capsid were associated with poor seed setting in some fields in 1941.

Recommendations for increasing the number of leaf-cutting bees comprise leaving strips throughout the lucerne fields and retaining logs and stumps near them in order to provide nesting sites, and reducing as far as possible other flowering plants, such as *Sonchus arvensis* and *Chamaenerion spicatum*, which are more attractive to the bees than lucerne. Increasing the acreage under lucerne is likely to disperse the bees and reducing it may result in the tripping of a greater proportion of the available flowers, though small changes in acreage would probably have little effect. The bees were most active in young, vigorous stands, and in small areas were observed to trip flowers on only one or two of the plants present. It is therefore considered probable that the improved yields observed following certain cultural practices may depend on increased attractiveness of the flowers to the bees.

McKenzie (H. L.). **The seasonal History of *Matsucoccus vexillorum* Morrison (Homoptera : Coccoidea : Margarodidae).**—*Microentomology* **8** pt. 2 pp. 42–47, 5 figs., 8 refs. Stanford Univ., Calif., 1943. **Notes on *Matsucoccus vexillorum* Morrison (Homoptera : Coccoidea : Margarodidae).**—*T.c.* pp. 53–54, 3 figs., 1 ref.

The following is largely based on the author's summary of the first paper. In Arizona, *Matsucoccus vexillorum*, Morrison, was found to be responsible for the killing of branches of *Pinus ponderosa* var. *scopulorum*. Seasonal life-history records indicate that the motile adult females and winged males emerge early in spring. The females settle at the nodes of branches, secrete a covering of fluffy white wax and deposit their eggs. The larvae pass through two stages with appendages during the summer and then moult again to become apodous preadults that overwinter under bracts enclosing the bases of the needles. A year is required for the complete life-cycle. A study of histological preparations of the plant tissues indicated that the Coccids obtain their food from cortical storage cells ; when they feed in groups, a necrosis of the plant cells is produced,

accompanied by an internal breakdown of the cell contents and the disintegration of the cell walls. *M. vexillorum* is rather generally distributed throughout the range of *P. ponderosa scopulorum* in the forested areas of Arizona and New Mexico and has not yet been found on any other food-plant or outside this region. The principal factor in natural control is the dying of the branches on which it is developing in large numbers. This accounts for fluctuations of " flagging " in the same area in successive years.

Other species of *Matsucoccus* known to be injurious to pines are *M. acalyptus*, Herbert, which was described from *P. monophylla* in Idaho [*R.A.E.*, A **9** 201] and caused heavy defoliation of *P. edulis* in Arizona in 1938, *M. gallicolus*, Morrison, which attacks *P. rigida* [in the eastern States], and *M. paucicicatrices*, Morrison, on *P. lambertiana* [**30** 1], *M. fasciculensis*, Herbert, on *P. sabiniana* and *P. ponderosa*, and *M. bisetosus*, Morrison [**30** 517] and *M. californicus*, Morrison, on *P. ponderosa*, which cause stem and foliage injury in California.

The second paper comprises descriptions of all stages of *M. vexillorum* except the eggs, which, with other stages, are briefly described in the first.

Slate (W. L.). **Report of the Director for the Year ending October 31, 1942.**—*Bull. Conn. agric. Exp. Sta.* no. 468 pp. 57–95. New Haven, Conn., 1943.

Much of the information in the section (pp. 64–70) that deals with entomological work in Connecticut during the year ending 31st October 1942 has been noticed from the Entomologist's report [*R.A.E.*, A **32** 91]. Many trees of apple, horse chestnut [*Aesculus hippocastanum*] and elm were completely defoliated by adults of the Japanese beetle [*Popillia japonica*, Newm.] at two places in the heavily infested area ; they also damaged the fruit of peach, plum and some varieties of early apple in one county, and the foliage of grape vines was extensively injured in the areas of general infestation. Injury to economic plants is most severe in heavily-infested areas where there is much open grassland and relatively little woodland. The effect on the larvae of lead arsenate applied to the soil was found to be markedly retarded as the soil temperature fell from 87 to 57°F. A succession of mild winters had enabled the population of the European pine shoot moth [*Rhyacionia buoliana*, Schiff.] in a plantation of red pine [*Pinus resinosa*] near the coast to build up to such an extent that severe injury was noticeable on many of the trees. In the cold winter of 1941–42, however, mortality of the overwintering larvae was as high as 92 per cent. [*cf.* **32** 96]. In certain parts of northern Connecticut, where the normal winter temperatures are lower than near the coast, mortality was also lower, and it is suggested that a race resistant to cold is gradually developing there.

Sleesman (J. P.). **Variations in Thrips Populations on Onions.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **28** no. 221 pp. 96–100, 6 refs. Wooster, Ohio, 1943.

Investigations on the control of *Thrips tabaci*, Lind., on onions and the resistance of varieties to its attack were carried out in Ohio in 1931–40. Control by insecticides was found to require frequent applications of costly materials to check reinfestation due to thrips protected between the inner leaves of the plants, emerging from pupae in the soil, or migrating from the numerous alternative food-plants. An account is therefore given of the resistance trials and their results [*cf. R.A.E.*, A **22** 536 ; **24** 90], and the results of similar trials by other workers are briefly reviewed [**21** 234 ; **23** 93 ; **24** 527]. The varieties were grown under conditions of natural infestation and counts were made of the numbers of thrips per plant. The mean numbers on the five varieties of greatest commercial importance in the United States, which were the most susceptible, were more than ten times as great as on a strain from Persia later named White Persian [*cf.* **23** 94] ; those on varieties of the Spanish type were intermediate. Several strains from other countries were also included in the

trials, but no variety was more resistant than White Persian. White Persian is undesirable as a commercial variety, since its keeping qualities are poor and it tends to produce double bulbs, but it is hoped to raise resistant varieties with good commercial qualities by crossing it with the varieties now in use.

Barber (H. S.). **Notes on *Rhabdopterus* in the United States (Coleoptera, Chrysomelidae).**—*Bull. Brooklyn ent. Soc.* **38** no. 4 pp. 111–120, 1 fig. Lancaster, Pa., 1943.

In this paper the author recognises six species of *Rhabdopterus* in America north of Mexico, three of which he describes as new, and gives a key to them, based on the aedeagus of the males, and notes on their synonymy. He points out that the identity of the genotypes of *Colaspis* and *Rhabdopterus* is not certain and that the two genera may not be distinct, but proposes to use the name *Rhabdopterus* for the species discussed.

Records of injury to cultivated plants in the eastern half of the United States, made under the name *R. picipes*, Ol., appear to refer to several species. It is considered that one of these, attacking grapes in Missouri and recently misidentified as *R. praetextus*, Say [*R.A.E.*, A **30** 133], is *R. deceptor*, sp. n., and that the cranberry rootworm in New Jersey may be *R. picipes* and not *R. praetextus*; the species attacking blueberry in North Carolina is probably also *R. picipes*. This species appears to occupy the coastal lowlands from the Mississippi Delta to Rhode Island, the inland margin of its area being in contact with that of *R. praetextus*, which occurs in the inland region from Quebec to Rio Grande, reaching Philadelphia, Washington, D.C., and Florida; both species are found at Philadelphia and Washington and in the south. *R. deceptor* occurs in the inland region from Alberta to Texas and New York. Of the other species discussed, *R. bowditchi*, sp. n., is known only from southern Florida, *R. spiculatus*, sp. n., from New Hampshire and Massachusetts and *R.* (*Colaspis*) *weisei*, Schaeffer, from Brownsville, Texas. *R. bowditchi* is stated to have been injurious to avocado.

Knowlton (G. F.). ***Nabis alternatus* Feeding Observations.**—*Bull. Brooklyn ent. Soc.* **38** no. 4 p. 122. Lancaster, Pa., 1943.

The author reports that *Nabis alternatus*, Parshley, was observed in Utah in 1942 feeding on Aphids of various species, including *Myzus persicae*, Sulz., on potato, *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on lucerne [*cf. R.A.E.*, A **27** 30] and *M. avenae*, F. (*granarium*, Kby.) on grass. A female was also found feeding on a leafhopper nymph on birch foliage, and, when caged with miscellaneous insects from roadside plants, it attacked an adult of *Typhlocyba rosae*, L.

Romney (V. E.). **The Beet Leafhopper and its Control on Beets grown for Seed in Arizona and New Mexico.**—*Tech. Bull. U.S. Dep. Agric.* no. 855, 24 pp., 9 figs., 11 refs. Washington, D.C., 1943.

The following is based on the author's summary. Beets grown for seed in the Salt River and Safford Valleys of Arizona and in the Mesilla Valley, New Mexico, are subject to autumn infestation by *Eutettix tenellus*, Baker, which transmits the virus of curly-top [*Chlorogenus eutetticola* of Holmes] from plant to plant. The principal source of this leafhopper is adjacent semi-desert land where *Pectis papposa*, *Tidestromia lanuginosa*, *Trianthema portulacastrum* and *Acanthochiton wrightii* serve as food-plants from July to September or later. The second generation of leafhoppers from these plants usually infests the

beets, although in Arizona when September rains are heavy, the third and fourth generations produced on summer food-plants may also infest beets in the Salt River Valley.

The variety of beet, the stand of plants, the rate at which the soil surface becomes covered by beet foliage, and the degree of shading are important factors determining the number of leafhoppers that a field of seed beets can tolerate without noticeable damage from curly-top. Observations made on non-resistant varieties indicate that in Arizona, with 700–1,000 plants per 100 ft. of row, 125–150 leafhoppers per 100 ft. of row are required to cause appreciable damage, since such stands can tolerate infection with curly-top of about 20 per cent. of the plants. An infestation of only 75–100 leafhoppers per 100 ft. of row containing 600–800 beets has caused sufficient injury in the Mesilla Valley to warrant insecticide treatment. In both districts it has been found that a reduction in the yield of seed may be caused by fewer leafhoppers in thin stands than are necessary to cause similar injury in dense stands.

Curly-top reduces the seed yield somewhat in proportion to the severity of the disease. Plants severely diseased by late April do not usually produce seed, and those more lightly attacked produce less seed than healthy plants ; the disease apparently does not materially reduce the viability of the seed. Experiments during 1935–41, which are described in detail, showed that significant reductions in the incidence of curly-top and increases in the seed yields occurred when the fields were sprayed in autumn with a mixture of 10 parts highly refined petroleum oil (viscosity 90–100 secs. Saybolt at 100°F., 94 per cent. unsulphonated residue), 20 parts kerosene and 1 part extract of pyrethrum flowers in petroleum oil with a pyrethrin content of not less than 2 gm. per 100 cc. for the control of damaging infestation by *E. tenellus*. Applications at the rate of 6–9 U.S. gals. per acre caused satisfactory reductions in the numbers of leafhoppers ; 6 U.S. gals. was enough at 50–75°F., but more was required as the temperature rose, 9 U.S. gals. being sometimes necessary at about 95° to obtain large reductions. Wind velocities above 8–10 miles per hour also limit the effect of the insecticide, and both temperature and wind velocity should be considered when deciding on the rate of application. The spray should be applied as soon as possible after damaging infestations occur in the seed-beet fields, such as are usually found in September, late October or late November, the time coinciding with leafhopper brood development or the drying of the food-plants in the semi-desert breeding areas. The most severe infestations have occurred in late October or later in both Arizona and New Mexico. Beets planted between mid-August and early September and given good cultural care can usually be made practically to cover the soil surface in the fields with foliage within about 50 days. Fields with over 95 per cent. of the ground covered with beet foliage have been found to provide an unfavourable habitat for *E. tenellus*, and if this condition is attained by late October or sooner, the fields will apparently not be subject to subsequent infestations and injury. Such cultural practices are highly recommended as an aid to the reduction of injury.

Black (L. M.). **Two new Viruses transmitted by Agallian Leaf Hoppers.** (Abstract.)—*Phytopathology* **33** no. 12 p. 1110. Lancaster, Pa., 1943.

The discovery that *Aceratagallia sanguinolenta*, Prov., transmits only the New York variety of the yellow-dwarf virus of potato [*Marmor vastans* var. *vulgare* of Black] and *Agallia constricta*, van D., only the New Jersey variety [*M. v.* var. *agalliae* of Black] of it [*cf. R.A.E.*, A **31** 4] suggested that other leafhoppers might be natural vectors of other yellow-dwarf viruses. Tests with *Agalliopsis novella*, Say, on crimson clover [*Trifolium incarnatum*] demonstrated the existence of two new viruses, one transmitted by this leafhopper only and the other by it and also by *Agallia constricta*.

LEACH (J. G.) & CLULO (G.). **Association between *Nematospora phaseoli* and the Green Stinkbug.**—*Phytopathology* **33** no. 12 pp. 1209–1211, 6 refs. Lancaster, Pa., 1943.

One of the commonest forms of stigmatomycosis in the United States is yeast spot of beans, which is caused by *Nematospora phaseoli*. This fungus was shown by Wingard to be carried by *Acrosternum* (*Nezara*) *hilare*, Say [*cf.* *R.A.E.*, A **14** 298], but he failed to isolate it from the bug. The disease is common on lima beans in south-eastern Virginia, but has been recorded in only a few instances from West Virginia. In the summer of 1941 an investigation of its association with *A. hilare* was carried out to ascertain the method of transmission and whether the pathogen overwintered in the body of the bug. The disease was not found in West Virginia, although the bug was fairly prevalent on lima beans and on various wild plants, but the fungus was isolated from the surface of bugs taken on diseased lima beans in south-eastern Virginia, though it was not recovered from their internal organs. A comparison of the size of the vegetative cells of the fungus and of the smaller measurements of the mouth-parts of the bugs show that internal transmission is unlikely, but it is possible that the fungus overwinters in the form of resistant cells, or spores, on the external parts of the bugs. It is more likely, however, that the bugs become contaminated in the spring by feeding on infected material, possibly on the wild plants that they usually attack before they migrate to lima beans [*cf.* **23** 273]. The natural host range of *N. phaseoli* is not known, but this hypothesis is supported by the fact that the disease is more prevalent in regions with mild winters, where plant tissues and actively growing cultures of the fungus are more likely to survive.

HAYSLIP (N. C.). **Notes on biological Studies of Mole Crickets at Plant City, Florida.**—*Florida Ent.* **26** no. 3 pp. 33–46, 2 figs., 4 refs. Gainesville, Fla., 1943.

The results are given of investigations carried out mainly in 1942 on the bionomics of *Scapteriscus acletus*, Rehn & Heb., and *S. vicinus*, Scud., which had caused severe damage to farms, gardens, lawns and golf courses in central Florida, with some data on *Gryllotalpa hexadactyla*, Perty, which had not increased so much.

Both species of *Scapteriscus* deposit their eggs in sealed cells, each containing about 35, in the soil at depths varying from one inch in warm moist soils to about one foot in cold dry ones, but chiefly in the top five inches where vegetable crops are grown. Oviposition began towards the end of March in 1942, a month earlier for insects that overwintered as adults than for those that overwintered as nymphs, and reached a peak in May. The last eggs of *S. vicinus* were laid towards the end of July and those of *S. acletus* in early September. The incubation period varied from 32 and 37 days, respectively, for eggs laid at the end of March, when the mean temperature was 69·3°F., to 11 and 16 days in July and August, when it was about 84°F. Newly hatched nymphs devoured eggs and other nymphs. Development was rapid during summer and adults began to appear in September, but very little growth occurred when the weather became cold, and about 15 per cent. of *S. vicinus* and 75 per cent. of *S. acletus* overwintered as nymphs in 1941 and 1942. There are flights of adults in spring and autumn, usually during warm weather and after a shower. They generally begin soon after dark and last for about an hour, but sometimes also occur on dark days. The adults are attracted to light and may be caught in light traps during these flights. *S. acletus* was the dominant species during autumn flights, but both species took part in the spring ones. Both appear to have a life-cycle of about a year. In the laboratory, the oviposition period of individual females averaged 33 days for *S. vicinus* and 61 days for *S. acletus* and the peaks of adult mortality occurred in June and July, respectively.

The mole crickets uproot plants in seed beds, where the moist loose soil is a favourable habitat, and uproot or chew and sever the roots and stems of newly transplanted seedlings; they may also reduce the vigour of the plants by constant burrowing round the roots. They also feed on decomposing organic matter in the soil, and animal matter, including other mole crickets, and are attracted to wheat bran, maize meal and cottonseed meal. Maize syrup, cane syrup and honey appear to add to the attractiveness of some materials, but not of wheat bran. Most surface feeding occurs when the soil is moist and the weather warm, at night or in the late afternoon. *S. vicinus* appears to cause most of the damage due to direct feeding and *S. acletus* most of that due to surface burrowing. Birds, fowls, skunks and toads prey on mole crickets in Florida, where they are also attacked by the predacious Reduviid, *Sirthenea carinata*, F., which is numerous in certain areas, and by two fungi, *Metarrhizium anisopliae* and *Sorosporella uvella*, particularly in the adult stage; the fungi are more prevalent on *S. vicinus* and appear to be causing a considerable reduction in its population.

G. hexadactyla is found in the heavier moist soils and is not injurious in most market gardens. The female deposits 30–70 eggs in a cell that opens into its permanent burrow. Most of the eggs are laid in May. In cages, the nymphs hatched in an average of 19½ days and transformed to adults in October and November. The adults have not been observed in flight. The author considers that in view of the fact that the main oviposition and hatching periods for all the species of mole crickets in Florida coincide so closely, deep ploughing in April–June should be considered as a method of control.

In the final section, the information obtained in these investigations is compared with data from Porto Rico on *S. vicinus* [*cf. R.A.E.*, A **6** 390].

Blackmon (G. H.). **The Tung-oil Industry.**—*Bot. Rev.* **9** no. 1 pp. 1–40, 143 refs. Lancaster, Pa., 1943.

This paper includes a very brief note on pests and diseases of the tung tree (*Aleurites fordi*) in the United States. The insects mentioned are *Aspidiotus hederae*, Vall., *Hemiberlesia* (*A.*) *lataniae*, Sign., and *Icerya purchasi*, Mask., which occur on the trees, but have not so far proved injurious. *Icerya* can be controlled by releases of *Rodolia* (*Vedalia*) [*cardinalis*, Muls.] and the others by a dormant spray of lime-sulphur or oil emulsion.

Richardson (H. H.), Johnson (A. C.), Bulger (J. W.), Casanges (A. H.) & Johnson (G. V.). **Studies of Methyl Bromide in Greenhouse and Vault Fumigation.**—*Tech. Bull. U.S. Dep. Agric.* no. 853, 20 pp., 3 figs., 26 refs. Washington, D.C., 1943.

The following is based on the authors' summary. Insecticidal, chemical and plant-tolerance tests were carried out in 1936–41 to investigate the efficiency of methyl bromide in greenhouse and vault fumigation. Rapid evaporation of the fumigant was obtained by spraying the liquid or by heating it in a shallow pan, and slow evaporation by exposing it in the shallow pan at normal temperature. The concentrations rose to nearly 100 per cent. of the dosage soon after the beginning of fumigation by rapid vaporisation and decreased to about 70 and 25 per cent. after 22 hours in metal-lined and concrete vaults, respectively, but practically no gas remained after six hours in a greenhouse from a dosage of 2 lb. per 1,000 cu. ft. in winter fumigations. A load of potted plants occupying about 40 per cent. of the space in a metal-lined vault reduced the gas concentration by about 8–10 per cent. when the soil in the pots was damp; when it was wet, concentrations were slightly higher for the first 4–6 hours, but decreased to 50 per cent. of the original dosage after 22 hours. In vault fumigation, fast vaporisation was more effective in insect control than slow vaporisation in 6-hour exposures, but there was little difference in 16½-hour

exposures. The gas stratified near the floor when vaporised slowly at the top with fan circulation for only the first ten minutes, but after a dosage had been completely vaporised and well mixed, no separation of the heavy gas occurred over a $2\frac{1}{2}$-hour period with the fan shut off. In greenhouse fumigation, fast spray vaporisation gave much higher peak concentrations than slow pan vaporisation, but the average gas concentrations were about equal in the two methods. Both methods usually gave good gas distribution in both summer and winter and differed little in insecticidal efficiency. From a practical standpoint, the spray vaporisation is preferred. Vaporisation by heat appeared efficient but less convenient. Temperature seemed to be an important factor, efficiency in both greenhouse and vault fumigations being higher at 77–81°F. and lower at 58–59°F. than at 66–69°F. The presence of high or low relative humidity either during or after fumigation did not appear to affect efficiency against *Phenacoccus gossypii*, Tns. & Ckll., on chrysanthemum, or *Tetranychus bimaculatus*, Harvey, on rose, but mortality of *Tribolium confusum*, Duv., was greater in fumigations at high humidity. A dosage of $1–1\frac{1}{4}$ lb. methyl bromide per 1,000 cu. ft. gave complete kill of *Tarsonemus pallidus*, Banks, on *Cyclamen* or *Antirrhinum*, *Tetranychus bimaculatus* and *P. gossypii* in overnight fumigations at approximately 67°F. under dry or fairly dry conditions in winter in a small greenhouse. In summer, when the heating system was off, the dosage could be reduced by approximately one-half at similar temperatures. In winter, practically all insecticidal action took place in the first six hours, but in summer it probably extends over a longer period. Methyl bromide at ordinary dosages penetrated efficiently into the dry or damp soil in pots or on a bench in the greenhouse ; efficiency against insects in the soil was somewhat less at a depth of five inches in floor soil beds. Little penetration took place when the soil was saturated with moisture. Watering the floor and bench soil heavily just before fumigation against insects on foliage made it possible to reduce dosages still further by eliminating the loss of gas into the soil. In wetting the soil, it is advisable not to wet infested plant foliage. Windy weather appeared to lower the efficiency of the fumigation. No accumulation of methyl bromide or other toxic gases appeared to occur in a greenhouse that received ten fumigations in one month. Under certain conditions some gas remained after greenhouse fumigation, and it seems advisable to ventilate thoroughly after each treatment. Ventilation for 20 minutes was sufficient to remove practically all gas in one case, but this period will probably vary with different conditions.

The efficiency of methyl bromide varied widely against the various pests tested. *Tribolium confusum* was the most resistant, and *Tarsonemus pallidus*, *Tetranychus bimaculatus* and *P. gossypii* were among the more resistant ; the fumigant appeared to be effective against a number of other greenhouse pests. A total of 36 plants or plant varieties appeared to be tolerant to greenhouse fumigations at 66–70°F. with dosages sufficient to kill *T. bimaculatus* ; five species were intolerant. Varietal differences were sometimes great. The presence of sunlight during the first part of a fumigation period did not appear to affect plant tolerance, but it is best to begin the fumigations at night or under overcast conditions. Some plants appeared to be more tolerant under wet conditions, but others were unaffected by moisture. No detailed studies were made on residual effects on growth or yield of flowers.

KITCHING (R. A.). **Report of the Department of Agriculture (British Honduras) for the Year 1942.**—[12] pp. [Belize, 1943.]

Swarms of *Schistocerca paranensis*, Burm. [*cf. R.A.E.*. A **29** 498] that had apparently spent the winter months on the mountain Pine Ridge, invaded the Cayo district of British Honduras in March–April 1942, while other swarms that appeared to have come from the Peten district of Guatemala were observed in May. Egg-laying was first reported in March, and hatching in April, and

new egg-laying continued until October. Damage to maize and beans amounted to about 25 per cent. of the crop and would have been more but for the prompt action taken in digging up eggs, and spraying and burning hoppers.

HINTON (H. E.). **Notes on two Species of *Attagenus* (Col., Dermestidae) recently introduced into Britain.**—*Ent. mon. Mag.* **79** no. 953 pp. 224–227, 1 fig. London, 1943.

Of the three species of *Attagenus* hitherto recorded in Britain, only *A. pellio*, L., is native to the country. *A. trifasciatus*, F., is a native of southern Europe, where, however, it is not found in houses or stored products, and it has not been observed in Britain since it was found on bird skins and in houses in Edinburgh and London early in the nineteenth century. *A. piceus*, Ol., which is a serious pest of stored products and is nearly cosmopolitan in distribution, was first recorded in Britain in 1868 and is now established there. Two further species, *A. gloriosae*, F., and *A. alfierii*, Pic, have recently been taken in British ports on stored products from India. *A. gloriosae* is nearly cosmopolitan, but is not yet established in Europe. It was first observed as a household pest in Hawaii [*cf. R.A.E.*, A **5** 399], has become an occasional pest in houses, warehouses and granaries in Barbados, Jamaica, Java and Egypt, and has been recorded on ground-nuts [*Arachis hypogaea*] and furs imported into Holland. The larvae feed on skins, furs, woollen goods, horsehair, feathers and museum specimens, and though they have been found in ground-nuts, grain damaged by insects and barley malt, there is no evidence that they can subsist on vegetable products alone. The materials on which this species has been taken in British ports include celery seeds, fleshings, myrobalans [*Terminalia*], divi-divi seed [*Caesalpinia coriaria*] and ground-nuts. *A. alfierii*, which is common in stores of drugs in Cairo and probably feeds on the remains of other insects [*cf.* **22** 563], has been taken on myrobalans. Brief notes are given on characters distinguishing *A. gloriosae* and *A. alfierii* from other species of the genus, together with keys to the adults of all five species and to the mature larvae of *A. pellio*, *A. piceus* and *A. gloriosae*.

CHRYSTAL (R. N.). **Galls of *Adelges* (*Gillettea*) *cooleyi* Gillette (Hem., Adelgidae) on Sitka Spruce in Cumberland.**—*Ent. mon. Mag.* **79** no. 953 p. 233. London, 1943.

In February 1943, the author received galls of *Chermes* (*Adelges*) *cooleyi*, Gill., which were stated to be abundant on Sitka spruce (*Picea sitchensis*) in plantations in Cumberland. This is apparently the first time that the galls have been found in England [*cf. R.A.E.*, A **10** 605] though they have been recorded from Scotland [*cf.* **24** 791]. The Aphid is common throughout the country on Douglas fir [*Pseudotsuga taxifolia*], its secondary food-plant. The gall can be distinguished from those of other species of *Chermes* (*Adelges*) on spruce by its elongate form. It completely encircles the shoot.

BEIRNE (B. P.). **The Biology and Control of the Small Ermine Moths (*Hyponomeuta* spp.) in Ireland.**—*Econ. Proc. R. Dublin Soc.* **3** no. 15–16 pp. 191–220, 38 figs., 26 refs. Dublin, 1943.

The author describes characters distinguishing the larvae and adults of the three common species of *Hyponomeuta* (*padellus*, L., *cognatellus*, Hb., and *euonymellus*, L.), records their food-plants and distribution in general and in Ireland, and gives an account of the bionomics of *H. padellus*, based on the literature and on observations of infestations on apple and hawthorn (*Crataegus oxyacantha*) in various parts of Ireland in recent years. He discusses the occurrence of biological races of this species [*cf. R.A.E.*, A **18** 692 ; **19** 584] and distinguishes four, *viz.*, the typical or hawthorn race, the closely allied one

on *Prunus spinosa* (blackthorn), the apple race (*malinellus*, Zell.), and the race on plum, for which he uses the name *variabilis*, Zell. The eggs of *H. padellus* are laid in batches, covered by a protective shield, in July and early August, and most of the larvae hatch in about three weeks, but remain under the shield during autumn and winter ; a few larvae did not hatch until early spring. They leave their shields and feed on the buds and young leaves for about ten days during May. In 1943, pupae were first observed on 17th June and most of the adults emerged about the second week in July. The eggs of the typical race are usually deposited on the spines of the hawthorn, but sometimes on the main stem. The number of eggs per batch ranged from 14 to 71 ; the larvae burrow into the buds and spin a mass of web that may cover the whole tree in a heavy infestation. They pupate in thin silken cocoons scattered singly or in small groups in the web and often among dead leaves on the ground. The eggs of the apple race (*malinellus*) are deposited in larger masses, on the main stems more frequently than on the spurs ; the larvae penetrate the leaves and feed between the upper and lower surfaces and form a more compact web, in which they congregate and pupate in groups, usually attached to the lower surfaces of leaves or branches. The plum and blackthorn races appear to be similar in habits to the typical race.

The larvae and pupae were destroyed by birds, parasitic protozoa and parasitic and predacious insects. In one outbreak on hawthorn, at least 95 per cent. of the larvae were killed by birds. Of the remaining larvae, 10 per cent. were destroyed by *Gregarina* sp. and 7 per cent. by insect parasites. *Ageniaspis fuscicollis*, Dalm., and *Angitia armillata*, Grav., were the most important of these, each parasitising about 3 per cent. of the larvae. A single egg of *Ageniaspis*, which develops polyembryonically, is deposited in the embryo of a host egg during August. The embryos develop into larvae when the host larva has begun to spin its cocoon and rapidly consume its body contents, before pupating within it. The average number of adults bred from a single larva was 56 ; no males developed. Females of *Angitia* were frequently observed ovipositing in the evening during the early part of June, a single egg being usually laid in each larva. The parasite larva matures in three weeks or less, when the host is usually beginning to spin its cocoon, and leaves the host to pupate. The adult emerges about ten days later, during the first or second week of July ; 86 per cent. of the adults bred were females. Two other species of Ichneumonids, both similar to *Angitia armillata*, were also bred. An average of 30 per cent. of the larvae of *Angitia* were themselves parasitised by a species of *Mesochorus*, probably *M. vitticollis*, Hlmgr., which lays its eggs singly in them while they are in their hosts. The *Angitia* larva is not killed until it has spun its cocoon, from which the adult hyperparasite emerges ; 75 per cent. of the adults bred were females. Other parasites observed comprised larvae and cocoons of an undetermined species of *Apanteles*, which were found at various times in June, and two Dipterous larvae that were probably Tachinids. Of the pupae, 8 per cent. were parasitised by *Herpestomus brunnicornis*, Grav., and 2 per cent. by *Pimpla turionellae*, L. The adults of the former emerged at about the middle of July, at the same time as the moths, and 75 per cent. of them were males. *P. turionellae* attacked the apple race more readily than the hawthorn race, and the adults emerged about three weeks after oviposition, at the same time as the moths or rather later. At least 15 per cent. of the pupae of *H. padellus* on hawthorn were destroyed by the predacious larvae of a Sarcophagid, probably *Agria mamillata*, Pand., one of which was observed to kill eight pupae in three days.

The life-histories of *H. cognatellus* and *H. euonymellus*, which feed, respectively, on *Euonymus* spp. and *Prunus padus*, are similar to that of *H. padellus*. *H. cognatellus* was found to be attacked by birds, *Gregarina* sp., *Ageniaspis fuscicollis*, *Angitia armillata*, *Pimpla turionellae* and the Sarcophagid identified as *Agria mamillata*, and *H. euonymellus* by *Angitia armillata*.

A list is given of the five other species of *Hyponomeuta* that occur in the British Isles, with their food-plants.

Reasons for the sudden outbreaks of any of the three common species are discussed, and it is concluded that in some years most of the larvae in certain localities escape destruction by birds ; heavy outbreaks are always eventually controlled by parasites, but this usually takes several years. The relative importance of the various natural enemies probably varies in different areas or parts of a single infested area, the parasitic Hymenoptera tending to be more abundant in dry and sunny localities and the Sarcophagid and probably also *Gregarina* in damp ones. Control measures include pruning infested trees in autumn or winter, and burning the prunings if possible ; removing collections of larvae or burning them on the tree with a blow-lamp, which, however, is said to impair the fruit-bearing capacity of apple trees ; shaking the larvae to the ground and destroying them ; and tearing down the webs frequently, to expose the larvae to birds. Spraying with a 10 per cent. tar distillate during December or with lead arsenate towards the end of April has been recommended.

Beirne (B. P.). **Some Observations on the Biology and Control of the Raspberry Moth** (*Incurvaria rubiella* **Bjerk.**) **in Ireland.**—*Econ. Proc. R. Dublin Soc.* **3** no. 15–16 pp. 221–226, 6 refs. Dublin, 1943.

Incurvaria rubiella, Bjerk., is one of the most important pests of raspberry and loganberry in Ireland, where it frequently becomes very abundant in gardens and may cause serious loss of fruit. It also feeds on wild blackberry but has not commonly been found on this plant in Ireland. This account of its bionomics and control is based on observations made in Co. Wicklow in 1942–43. The eggs are laid singly in the receptacles of the open flowers during June and hatch in 7–10 days. The larvae burrow into the receptacles and feed there until the fruit begins to ripen, but do no permanent injury to the blossom or fruit at this stage. When the fruit ripens, during July, they leave it and make cocoons among dead leaves or other débris at the base of the canes, in the soil or in crevices in walls, canes or supporting stakes, in which to overwinter. They emerge from these cocoons at about the beginning of April, crawl up the stems and burrow into the shoots. On raspberry they often attack the flower buds, and one larva may destroy several by hollowing them out, but on loganberry they usually feed on the pith of the shoots, causing them to wither without producing flowers. They become full-grown by about mid-May and pupate within the burrow near the tip of the shoot or in a cocoon on an adjacent leaf. The adults emerge three or four weeks later, usually during the first week in June, when the plants are in blossom.

The percentage of loganberry shoots infested averaged 27 on plants grown by a wall in ground that was not cultivated and 13 on plants in the middle of a garden in ground that was cultivated and cleared of débris. Raspberry was only slightly infested, as the canes had been sprayed with a tar-distillate wash during the winter and the ground under them had been cultivated and cleared. Normally, raspberry appears to be the more heavily attacked, possibly because the receptacles of the fruit are left on the plants when the fruit is picked, leaving the larvae within them undisturbed.

No parasites were found, and there was no evidence that the larvae were destroyed by birds, but an average of 12 per cent. died from unknown causes, the proportion being higher in shoots that contained two or more than in those with only one. Spraying with a tar-distillate wash (8 per cent.) in December or January has been stated to control the larvae almost completely ; other measures include picking off withered shoots in spring and burning them, and removing dead leaves and other débris from the base of the canes during winter, forking up and raking the ground round the canes and burning old canes and stakes to destroy the hibernating larvae.

WILSON (G. F.). **The Lily Beetle,** *Crioceris lilii* **Scopoli : its Distribution in Britain (Coleoptera).**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 10–12 pp. 85–86, 1 fig., 8 refs. London, 1943.

The author gives records and a map showing the localities in England and Wales from which *Lilioceris* (*Crioceris*) *lilii*, Scop., has been recorded [*cf. R.A.E.*, A **30** 613] and states that in 1943 this Criocerid was observed at two further places in Surrey, on *Lilium philippinense* var. *formosanum*, *L. auratum* var. *virginale*, *L. giganteum*, *L. regale* and *Nomocharis saluenensis*. It has now become established in this county.

FORD (R. L. E.). **On collecting and rearing parasitic Hymenoptera with special Reference to the Genus** *Apanteles* **(Hym. Braconidae).**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 10–12 pp. 89–94, 6 refs. London, 1943.

The notes here given on methods of obtaining Hymenopterous parasites, particularly those of the genus *Apanteles*, are by the late D. S. Wilkinson. When a large variety of species is required, sweeping with a net is the best method to adopt, and if the host larvae cannot be collected and reared, is the only one possible. If biological information is required, three or more persons should sweep the same area, to equalise differences in individual collecting, and a knowledge of breeding habits will facilitate catches of both sexes, as more males are taken by random sweeping and more females in the immediate vicinity of hosts.

Very large numbers of Hymenopterous parasites can be obtained by collecting host larvae and rearing them to maturity or until the parasites emerge. These larvae should be collected in great quantities over a number of years and from widely distributed areas differing from one another, to allow for annual and local differences in parasitism. Long series of individuals also give more reliable indications of sex ratios, and the results obtained in this respect with 12 species of *Apanteles* are shown in a table. The main difficulty in this method is the rearing of the hosts. The larvae of most macro- and some microlepidoptera are best kept in a sleeve on the growing tree or food-plant. Many hundreds may be kept in one sleeve, but they should be examined every 8 days, the shortest period required [in Britain] for pupation and emergence of a parasite. The management of these sleeves, and also other methods of rearing host larvae and ways of collecting the emerging parasites are discussed from experience with the various species of *Apanteles*.

RILEY (N. D.). **An Occurrence of** *Nasutitermes costalis* **Holmgren in England (Isoptera).**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 10–12 p. 95. London, 1943.

In June 1942, a few specimens of *Eutermes* (*Nasutitermes*) *costalis*, Hlmgr., were received from Lincolnshire, where they had been found in a nest in packing material from Martinique.

Records of the introduction of termites into England are few, and the prospect of their breeding there small. A species of *Kalotermes* (*Calotermes*) was recorded in 1874 at Kew in the trunk of an East African tree (*Trachylobium*), and the Malayan termite, *K.* (*C.*) *artocarpi*, Hav., has been successfully reared under experimental conditions in England.

KRETOVICH (V. L.), BUNDEL (A. A.) & PSHENOVA (K. V.). **Mechanism of Wheat Injury by** *Eurygaster integriceps*.—*C. R. Acad. Sci. URSS* (N. S.) **39** no. 1 pp. 31–33, 1 graph, 8 refs. Moscow, 1943.

It has been shown that the gluten of wheat grains injured by Pentatomids contains highly active proteolytic enzymes and that the amylase in them is more

active than that in uninjured grains. The enzymes present in the alimentary canal of *Eurygaster integriceps*, Put., were investigated in this connection in Kirghizia and an account of the results is given, together with a review of previous work from the literature. There is only one generation of *E. integriceps* a year, and the adults feed first on the leaves and stalks of the young wheat plants and later on the ripening grains. The salivary glands of adults examined during the period of stalk formation were white in colour and the fore-gut contained a mass of dark green vegetable material. Aqueous extracts of both organs displayed a strong amylolytic action, and that from the fore-gut was also found to contain a proteinase ; the gluten of flour prepared from uninjured wheat was not impaired by these extracts, or by others in sodium-carbonate solution. The salivary glands of adults examined when the grains were ripening were greenish-yellow and the fore-gut contained yellow-brown matter that when tested gave evidence of the presence in abundance of products of protein digestion. Extracts from both organs contained an active proteinase and a highly active amylase. An extract of the salivary glands in sodium-carbonate solution completely destroyed the gluten of normal wheat flour, but an aqueous extract failed to do so until sodium carbonate was added to it. Aqueous extracts of the fore-gut exerted a strong proteolytic action on the gluten of normal flour, and this was weakened, but not destroyed, by boiling, indicating that substances capable of activating the proteolytic enzymes contained in the flour were present. The wheat germ has been shown to be particularly rich in activators of this kind, and a quantitative analysis of an extract prepared from the fore-gut of adults at the time when they were feeding on wheat grains demonstrated the presence there in large quantities of activators, which facilitate the digestion of protein.

MOUTIA (L. A.) & MAMET (R.). **Experiments on the Storage of Maize Seeds.**—*Rev. agric. Maurice* **22** no. 1 pp. 5–9, 1 fldg. table. Port Louis, 1943.

The results are given of experiments on the effect of various treatments on the germinating power and infestation by insects of maize stored for seven months in various ways in Mauritius. Maize stored on the cob became 100 per cent. infested whether or not it was treated with a 1 per cent. emulsion of diesel oil. Most of the insects concerned were *Sitotroga cerealella*, Ol., but *Calandra oryzae*, L., was also present. Shelled maize, stored with or without a fumigant in drums and exposed to the sun every two months or in tins that were hermetically sealed, became much less infested, the former method being the more effective. The fumigants tested were petrol and crude naphthalene. The former was in general ineffective, but the latter afforded considerable protection against insect infestation and loss of germinating power, as compared with the controls.

Notes sur quelques insectes nuisibles à la culture du maïs.—*Rev. agric. Maurice* **22** no. 1 pp. 11–12. Port Louis, 1943.

In view of heavy infestations of maize plantations by *Sesamia vuteria*, Stoll, and *Crambus malacellus*, Dup., that occurred in Mauritius in December 1942 and January 1943, methods of controlling these borers are discussed. *S. vuteria*, which is a pest of young sugar-cane, is controlled in cane fields by the use of trap-crops of maize, and this measure might also be effective in maize fields; 3–4 rows of maize planted round the edges of the fields 15 days before the regular crop should be inspected at intervals, beginning 5–6 days after the plants first appear, and any plants showing signs of infestation collected and burnt immediately. *C. malacellus* usually bores in the stems of wild grasses , but attacks maize when these weeds are burnt in the course of clearing the fields, which also destroys numbers of parasites that attack the

borer. It is recommended that burning the fields should be discontinued and that trap-crops should be grown. The adult parasites feed on the flowers of l'herbe Condé [*Cordia interrupta*], and it is suggested that clumps of this plant should be left at intervals of 200–300 ft. near maize fields in order to attract them.

Bedford (E. C. G.). **The Biology and economic Importance of the South African Citrus Thrips,** *Scirtothrips aurantii* **Faure.**—*Publ. Univ. Pretoria* (2) Nat. Sci. no. 7, [3+] 68 pp., 3 pls., 7 figs., 16 refs. Pretoria, 1943.

Details are given of the methods and results of an investigation in the Rustenburg district of the Transvaal in 1939–40 of the bionomics of *Scirtothrips aurantii*, Faure, which is one of the most important insect pests of *Citrus* in the Union of South Africa and in Southern Rhodesia [*cf. R.A.E.*, A **18** 701]. It produces unsightly blemishes on large quantities of oranges every year as a result of feeding by larvae and adults and causes malformation of young shoots. It is widely distributed throughout both countries, where it is the only thrips known to damage *Citrus* foliage and fruit. In the veldt, it occurs chiefly on wild species of *Acacia*, but it is also found on a great variety of other wild and cultivated plants, including species of *Eucalyptus*. The amount of damage to the fruit varies in different years, in different localities and orchards and on different varieties of *Citrus*. Economic injury is confined chiefly to blemishes on oranges, particularly Washington navel oranges, and grapefruits ; lemons usually suffer little damage and mandarin oranges are rarely blemished. Badly blemished fruit becomes shrivelled twice as soon after picking as fruit with a healthy rind, the water content being decreased by abnormal loss of moisture through the damaged portion of the rind. Thrips marking and browning were severe during the season of 1938-39, when the weather in July-November was very hot and dry, whereas damage was slight in the following season, when the same period was much cooler and wetter.

The adults, particularly the males, are active and positively phototactic and usually occur only on young foliage and tender fruit. They died within five days without suitable food and failed to survive and breed on hard old orange leaves. In the field, females are more abundant than males. Reproduction is normally bisexual, but parthenogenesis occurs. Breeding continues and all stages are present during the winter, but the thrips in the orchards occur only on out-of-season shoots and fruits and are few in numbers because of the scarcity of suitable food and the lower temperatures, which prolong development. The eggs are deposited chiefly in the soft tissue of small green fruits, but also in the stem and leaves of young shoots or the rind of large fruits. The number of eggs produced per female per day averaged 1·2 during summer and 0·43 in winter. The average durations of the egg, larval and pupal (including prepupal) stages varied from 6, 7·6 and 4 days, respectively, during hot dry weather in summer to 24, 13·5 and 8 days in winter, the duration of all being closely correlated with temperature. The complete life-cycle varied from 18·4 days in summer to 44 in winter. The larvae feed on the plants until mature, when they drop off the tree, usually just after sunset, to pupate in the ground or possibly among débris.

The fluctuations of population observed in a fortnightly census in two orange orchards from the end of April 1939 to July 1940 were similar, and the findings in one of them are discussed. The thrips bred on young out-of-season foliage throughout the winter of 1939, but the insect and its food-supply both became very scarce during July. Out-of-season fruit was of very little importance, as it was scarce and had set early, but when such fruit sets in or after late autumn, it is still young and green during the winter and results in a higher initial infestation in spring by providing favourable breeding grounds. The initial infestation at the end of September was very low, and it was reduced by two applications of

sulphur dust during October. Adults began to move from the foliage to the setting fruit during the third week of October, and the total population of the second infestation increased steadily from the beginning of November, reached a maximum in the middle of January, when temperatures were highest, and decreased until July 1940. The fruit was blemished by the second infestation, chiefly during the second and third weeks of November, while it grew from 21 to 29 mm. in diameter, and probably no damage of any importance occurred after the beginning of December. Damage was comparatively light inside the two orchards, but distinctly greater on the trees along the margins, and thrips were more abundant on these trees during early summer, suggesting that a migration from the veldt occurred early in November, due perhaps to the hardening of the foliage of veldt food-plants ; discarded *Citrus* orchards, weeds and *Eucalyptus* windbreaks near the orchards may also have been sources of thrips. The investigations included counts of the insects caught in a trap designed by the author, but the results were somewhat inconclusive. The trap is described.

The principal natural factors that control the thrips are low temperatures, which reduce the rate of oviposition and development, scarcity of suitable food in winter, and rain, which washes the insects off the plants ; large numbers die in the pupal stage. None of the predators observed seemed to be of any importance at the time when the thrips is injurious to the fruit. They comprised the mite, *Anystis baccularum*, L., which feeds voraciously on larvae and adults, but is usually rare on orange trees ; *Haplothrips bedfordi*, Jac.-Guill., which feeds on the larvae and adults and possibly also on the eggs ; *Orius* (*Triphleps*) *thripoborus*, Hesse, which is common on young infested orange foliage only in April–July and probably attacks many other species of thrips on different plants [*cf.* **29** 320] ; small spiders, which probably feed on the larvae and adults but are not common in the orchards ; and the Coccinellids, *Exochomus melanocephalus*, Zoubkoff (*nigromaculatus*, Goeze) and *Scymnus trepidulus*, Weise, which are common on infested foliage during autumn and winter and may feed on the larvae.

The different types of surface injury produced on oranges by the thrips and by wind are described and discussed in some detail, and reasons are given for concluding that the " tear stains " on the side of the fruit are due directly to the feeding of the thrips and not to oil washed by rain from the lesions it causes at the stem end [*cf.* **18** 633, 702].

Where the thrips is of economic importance, it should be controlled by two applications of sulphur dust or lime-sulphur spray to the outside of the trees, the first being made when 75–100 per cent. of the petals have fallen and the second 6–10 days later. Approximately $\frac{1}{2}$ lb. dust or $3\frac{1}{2}$ gals. spray is used on a tree of average size. If the numbers of larvae begin to increase rapidly before the fruit is the size of a walnut, a third, applied 10–20 days later, probably in the first week in November, and possibly a fourth after another 6–10 days may be necessary. As early and as even a blossoming and setting of the crop as possible should be obtained by efficient irrigation, and out-of-season blossom and fruit should be removed from the trees.

PETTEY (F. W.). **Control of Cochineal in Spineless Cactus Plantations.**—*Fmg in S. Afr.* 1943 repr. no. 42, 4 pp., 2 figs. Pretoria, 1943.

Dactylopius opuntiae, Ckll., which has proved of considerable value against prickly-pear [*Opuntia*] in South Africa [*cf. R.A.E.*, A **32** 14], also attacks the spineless species of the same genus and may cause considerable damage unless controlled. It may be carried to the plantations in the active stages by insects, birds or mammals or by high winds, and will at first occur only in small numbers, probably on a few leaf pads of one plant. The infestation is very conspicuous, owing to the white cotton-like masses beneath which the scales live, and these

should be completely eradicated as soon as their presence is detected. Infested leaf pads should be removed and burnt or fed to stock, and any insects on stems or other plant parts should be destroyed by means of a blow-lamp. Further inspections should be made at short intervals, and the treatment repeated if necessary. Once the insect is well established and has spread over an appreciable area, eradication is impracticable, as no effective spray is known, and insecticidal treatment would in any case be too expensive for this crop ; regular inspection should therefore be made so that any infestation is detected soon after it appears.

Brimblecombe (A. R.). **The Potato Flea Beetle.**—*Qd agric. J.* **57** pt. 2 pp. 94–96, 5 figs. Brisbane, 1943.

Serious losses of potatoes were caused in two districts in Queensland in the autumn of 1943 by the potato flea-beetle [*Psylliodes* sp.], which occurs on this crop almost every year, but had not caused severe damage since 1916. As no control measures are normally required the damage was not observed until the plants were in flower. Brief descriptions are given of all stages of this Halticid, together with an account of the nature and extent of the injury it caused. Details of its bionomics are not yet available, but it is assumed that a single generation extends over about two months during the summer and considerably longer in winter. Damage is usually confined to feeding by the adults on the leaves, which does not as a rule cause economic loss, but that due to the larvae tunnelling in the stems and roots, particularly when it occurs at or near ground level, is serious, since it interferes with the translocation of food materials and provides a means of entry for rots. These rots are associated with severe wilt at the time of flowering, from which the plants seldom recover. Damage may begin in a part of the field adjacent to areas that provide shelter for the beetle, but frequently becomes distributed fairly evenly throughout. The adults also feed on tomato, egg-plant [*Solanum melongena*] and related weeds. One of these, black-berried night-shade [*S. nigrum*], which is often present in potato fields, is the only plant other than potato on which the larvae have been observed. Although injury was most severe on irrigated land, it was also serious on non-irrigated areas. Crops planted in January were almost completely destroyed, those planted in early February were more severely damaged than those set later in the month, and those planted in March escaped injury almost completely. No recommendations can as yet be made for preventing damage by the larvae, but spraying with 3 lb. lead arsenate in 100 gals. water at intervals of 7–10 days from the time when the adults appear on the plants may afford some protection by destroying the adults and the newly-hatched larvae that have not yet entered the stems.

Dumbleton (L. J.). **The Grass Grub** (*Odontria zealandica* **White) : a Review of the Problem in New Zealand.**—*N. Z. J. Sci. Tech.* **23** no. 6A pp. 305A–321A, 85 refs. Wellington, N.Z., 1943.

Apart from references to an unpublished manuscript by D. Miller, this paper is based entirely on the literature. Notes on the life-history of *Odontria zealandica*, White, and the damage caused by the larvae to pastures in New Zealand [*cf. R.A.E.*, A **29** 541] are followed by a discussion of the various factors that influence the abundance of injurious Melolonthids in other parts of the world and of methods of control, with special reference to *O. zealandica*. These include biological, cultural and direct measures, and a list is given of the insect parasites and predators of Melolonthids that have been introduced into New Zealand ; none has become established. In conclusion it is recommended that attention should be concentrated upon a thorough investigation of the life-history and ecology of *O. zealandica* and the possibility of changing

or modifying the types of pasture and methods of pasture management in the worst and most consistently affected areas ; parasites should be introduced from regions with a climate similar to that of New Zealand.

Flay (A. H.) & Garrett (H. E.). **The Grass-grub Problem. Farm Management and economic Significance in Canterbury Farming.**—*N. Z. J. Sci. Tech.* **23** no. 6A pp. 322A–329A, 7 refs. Wellington, N.Z., 1943.

This is a discussion of the losses and modifications of farming practice imposed on sheep farmers in New Zealand as a consequence of infestation of pastures by larvae of the Melolonthid, *Odontria zealandica*, White, and to a less extent those of Hepialids of the genus *Oxycanus* [*cf. R.A.E.*, A **29** 541]. Injury was particularly severe in 1937–39, and many thousands of acres of established and newly sown pastures were partly or totally destroyed in Canterbury and North Otago. Damage was most severe on the medium and lighter soils, and the loss of winter and spring grazing is aggravated by the damage to rape and other crops by the adult beetles. From an analysis of figures for farms in the four areas that suffered most, it is calculated that the annual financial loss due to infestation by *Odontria* averaged 6*s*. per acre if outbreaks such as that of 1937–39 occur in eight-year cycles.

Remedial measures recommended include an extension of the area under lucerne beyond what is required for hay so as to allow for compensatory grazing and, since established lucerne stands are seldom affected by *Odontria*, lengthening the life of periodically grazed stands by cutting hay once a year. Cocksfoot [*Dactylis glomerata*], which is resistant to infestation, may be sown with lucerne for grazing purposes. A supply of green fodder can be ensured by allowing a sufficient area of pasture each year to lie fallow for a long period and then sowing it with Italian rye-grass [*Lolium*] and red clover or oats. Permanent pasture should be sown in seasons when infestation is not severe ; wheat or oats should be sown early on severely infested land, and rape and turnip either before the adults of *Odontria* are in flight or after oviposition is completed.

Swan (D. C.). **The Bark-beetle *Hylastes ater* Payk. (Coleoptera, Scolytidae) attacking Pines in South Australia.**—*J. Dep. Agric. S. Aust.* **46** no. 5 pp. 86–90, 2 figs., 14 refs. Adelaide, 1942. [Recd. 1944.]

Hylastes ater, Payk., a European bark-beetle, was found attacking *Pinus radiata* in New Zealand in 1929 [*R.A.E.*, A **20** 719 ; *cf.* also **23** 438] and was observed in 1937 in pine plantations consisting chiefly of *P. radiata* at Mount Burr, South Australia [**28** 442] ; it is also present in forests at Penola. More recently, another European Scolytid, *Hylurgus ligniperda*, F., has been found in association with it at both Australian centres. Both have probably been present for at least 10 years. The distribution of the former and the appearance of the adults of both species are briefly described.

Observations by the author have shown that adults of *Hylastes ater* are present throughout the year ; they were taken in flight and in the bark of logs up to one year old that were lying in contact with the soil, and in that of stumps of the same age, in which the galleries mostly extended down to the bark of the main roots. The adults enter the bark, usually where it is in contact with the soil, of logs, prunings and slash in order to feed and breed. They breed in thick bark, but feed on the thin bark of slender twigs in contact with the soil. The eggs are laid in the chewed bark along the side of the tunnels, and the larvae mine at right-angles to the oviposition tunnels, so that the inner bark is often completely destroyed. Pupation occurs at the broader ends of the tunnels ; the pupal stage is short, but the adults may not emerge from the tunnels for several weeks. The abandoned bark is sapless and is invaded beneath by fungi, earthworms and insects, but the wood is usually undamaged.

The adults also feed on the root-bark of young growing pines, and killed about 50 per cent. of the seedlings planted out in July 1941 on an area of five acres at Mount Burr by stripping the bark from the stems and major roots. The seedlings began to die in September. The area had been cleared about a year before and the slash burned, but though the bark on the upper side of the logs was charred, the parts in contact with the soil, in which breeding occurs, were unaffected. *H. ater* has been recorded as killing well-established and mature Scots pines (*Pinus sylvestris*) in association with *Hylobius abietis*, L., in Britain [*cf.* **28** 409] and as destroying the bark and roots of trees up to ten years old in Germany [**12** 368]. The adults fly strongly and will doubtless invade other plantations in South Australia, and even western Victoria.

Control by means of trap logs [**20** 720] is impracticable in South Australia, where plantations are large and maintenance staffs small, and the current practice of planting seedlings on land that has previously carried pine forest, after burning the slash a year after felling, involves much risk of losses. Land for planting may need to be left for two years after felling and should be as far as possible from areas that are being felled.

DAVIDSON (J.) & SWAN (D. C.). **The Incubation Period of the Eggs of *Halotydeus destructor* Tucker (Acarina) at different Temperatures.**—*Aust. J. exp. Biol. med. Sci.* **21** pt. 2 pp. 107–110, 1 fig., 2 refs. Adelaide, 1943.

The incubation periods of eggs of *Halotydeus destructor*, Tucker, at different constant temperatures were determined by D. C. Swan in experiments extending over a period of seven years. The data were analysed to show the relation between temperature and rate of development by J. Davidson, using methods discussed in a previous paper [*R.A.E.*, A **31** 421], and the results are given. In all, 10,000 eggs were used in 21 experiments at 13 different constant temperatures ranging from 7·8 to 27·5°C. [45·04–81·5°F.], at which the mean incubation periods were 17·51 and 4·24 days, respectively, and about 90 per cent. hatched in each experiment except that at 27·5°C., in which only 51 per cent. hatched. The observed values for the length of the incubation period and the percentage of development completed each day at each temperature agree well with the corresponding values calculated from the exponential equation previously given [*loc. cit.*] up to 22°C. [71·6°F.], which is the temperature at which development was quickest (3·66 days). In the temperature-velocity curve, the greatest deviation from the calculated percentage at any of the ten observed points within this range was 0·971 at 20°C. [68°F.]. The standard deviation between the observed and calculated points for the ten given temperatures is 0·4468, which is 1·9 per cent. of the calculated value at 20°C.

CALDWELL (N. E. H.) & MAY (A. W. S.). **Fruit Fly Luring Investigations.**—*Qd agric. J.* **57** pt. 3 pp. 166–168. Brisbane, 1943.

Nearly 300 bait mixtures were tested in screw-top glass fly traps for use against fruit-flies in orchards of *Citrus* and deciduous fruits in Queensland in 1939–41. *Citrus* orchards were found the more suitable for the experiments, since large numbers of flies are almost always present in them during spring and autumn, whereas populations in deciduous orchards vary greatly from season to season and do not always permit significant results. The technique of the tests is briefly described. In all districts, and particularly in the coastal areas, many species of fruit-flies entered the traps, though a few well-known species made up most of the catch. Little is known of the habits and importance of the remainder, some of which are apparently undescribed. A bait of weak ammonia and vanilla has been used for many years against the Queensland fruit-fly [*Dacus ferrugineus tryoni*, Frogg.], but it was soon found that mixtures of

ammonia with pollard, bran or orris root were more attractive and that the addition of vanilla was unnecessary or even detrimental. Five baits are recommended for trial by growers. The most promising is prepared by steeping the finely-grated rind and rag of a ripe or ripening orange $2\frac{1}{2}$ ins. in diameter in $\frac{1}{4}$ pint water containing $\frac{3}{4}$ fl. oz. 18 per cent. aqueous ammonia in a tightly-corked container for 24 hours. The liquid, which is used at the rate of 1 fl. oz. in $3\frac{1}{2}$ pints water, attracts few insects other than Trypetids. It caught at least as many of the latter as any bait except one containing yeast and chemically pure ammonium carbonate, which had the disadvantage of catching large numbers of other insects. The other baits contained ammonium carbonate or ammonia with pollard, which also attracted many other insects, and ammonium carbonate with maize meal, which did not. The ammonia and pollard caught large numbers of fruit-flies but not so many as the baits containing ammonium carbonate. The traps should be recharged at intervals not exceeding six days and more frequently when evaporation is high and catches are large. If the bait is fouled by the presence of other insects, the traps should be thoroughly cleaned before recharging.

LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **14** no. 3 pp. 77–83, 22 refs. Suva, 1943.

Notes are given on the life-history and control of *Plutella maculipennis*, Curt., which is increasing in importance in Fiji, owing to greater cultivation of cruciferous crops ; it is often associated on them with *Crocidolomia binotalis*, Zell., which is also a serious pest, and its development lasts about a fortnight. *Thyraeella* (*Diadromus*) *collaris*, Grav., was introduced against it from New Zealand in March and May 1943, mass rearing was begun, and 240 individuals were liberated between June and the end of August. The period of development of the parasite in the host was 11–12 days in March, June and July in spite of variations of 7·7°F. in the mean monthly temperatures.

Borers taken from a bridge post of *Casuarina nodiflora* and avocado twigs have been identified as *Crossotarsus externedentatus*, Fairm., and *Xyleborus fijianus*, Schedl, respectively ; avocado trees are also attacked by *Hypothenemus peritus*, Bldf., *Lyctus parallelipipedus*, Melsh., and *Lyphia orientalis*, Blair, which apparently find favourable conditions in the branches and trunks. Of the insects associated with stored dry roots of derris [*R.A.E.*, A **31** 232], the Reduviid predacious on larvae of *Xylothrips religiosus*, Boisd., has been identified as *Peregrinator biannulipes*, Montr., the species of *Minthea* as *M. rugicollis*, Wlk., and the parasite of the larvae of one or both of these beetles as *Proamotura aquila*, Gir. *Dinoderus minutus*, F., recorded from the internodes of bamboo [**29** 170], is becoming important owing to the extended use of bamboo in buildings of native type. It is recommended that the bamboo poles should be allowed to dry or else be soaked in water for 3–4 days in order to dissolve the bulk of the attractive carbohydrates before being used.

LEVER (R. J. A. W.). **Division of Entomology. Annual Report for 1942.**—*Agric. J. Fiji* **14** no. 3 pp. 83–85. Suva, 1943.

Some of the information in this report on insect pests in Fiji has already been noticed [*R.A.E.*, A **31** 160, 232, 265, 361]. Those recorded during 1942 included *Agrotis ypsilon*, Hfn., on turnips, *Heliothis armigera*, Hb., on maize and peas, *Cirphis unipuncta*, Haw., on rice and maize, *Plusia chalcites*, Esp., on tomatos and beans, *Hymenia recurvalis*, F., on beet, *Acritocera negligens*, Btlr., boring in coconut spathes, and *Levuana iridescens*, B.-B., on coconut leaves ; *Catorama herbarium*, Gorh., was taken from books.

Liberations of *Microphanurus basalis*, Woll., against *Nezara viridula*, L., and of *Dirhinus* sp. against *Dacus* (*Chaetodacus*) *passiflorae*, Frogg., comprised

18,500 and 46,800 individuals, respectively [*cf.* **31** 41]. *Microphanurus* was released locally and also sent to New Caledonia. *Plaesius javanus*, Erichson, was sent to California by air for final liberation in Porto Rico against *Cosmopolites sordidus*, Germ., on banana. *Liothrips urichi*, Karny, was released on Viti Levu for the control of *Clidemia hirta* and *Teleonemia scrupulosa*, Stål, on Taveuni against *Lantana*. Parasites reared during the year comprised *Apanteles ruficrus*, Hal. (*antipoda*, Ashm.) from larvae of *Cosmophila flava*, F., *Apanteles* sp. from *Agonoxena argaula*, Meyr., *Brachymeria fijiensis*, Ferrière, from larvae of *Nacoleia diemenalis*, Gn., *Sturmia inconspicuella*, Baranov, from *Prodenia litura*, F., *Sclerodermus* sp. from *Catorama herbarium*, and *Diplazon laetatorius*, F., from *Syrphus corollae*, F.

Dodge (B. O.) & Rickett (H. W.). **Diseases and Pests of Ornamental Plants.**—Med. 8vo, xi+638 pp., illus. Lancaster, Pa., J. Cattell Press, 1943. Price $6.50.

The first part of this book (pp. 1–116) contains general information on the nature of plant diseases and the conditions and organisms that cause them. One of its four chapters comprises a brief survey of the characters of insects belonging to the Orders that are most injurious to plants, including those that are vectors of virus diseases and illustrated by reference to particular species, with notes on mites, Myriapods and other animal pests. Another deals with the various methods of control and the principles underlying them. The second part (pp. 118–613) deals with the diseases and insect and other pests most injurious in the eastern United States to some 600 ornamental plants, and consists of notes on the symptoms and injury they cause and on their control, arranged under the scientific names of the plants.

Campbell (F. L.) & Moulton (F. R.). Ed. **Laboratory Procedures in Studies of the Chemical Control of Insects.**—*Publ. Amer. Ass. Advanc. Sci.* no. 20, viii+206 pp., 62 figs., 12 pp. refs. Washington, D.C., 1943.

As pointed out in a foreword by Moulton, the papers of this symposium are designed to provide a systematic and thoroughly documented discussion of the principles and practices that meet the complicated problems involved in the rearing of insects of diverse kinds and the difficulties in the laboratory testing of insecticides due to the differences in insects, insecticides and methods of application. The basic plan of the discussion is to treat each general subject in a comprehensive paper and supplement it by shorter contributions on specific related subjects.

The papers dealing with the breeding of test insects comprise : Rearing Insects that attack Plants, by H. A. Waters (pp. 3–28), supplemented by contributions on plant bugs, by H. Menusan jr. (pp. 29–30), the corn earworm (*Heliothis armigera*, Hb.), by A. E. Michelbacher (p. 30), the larger canna leaf roller (*Calpodes ethlius*, Cram.), by C. M. Williams (pp. 30–31), the large milkweed bug (*Oncopeltus fasciatus*, Dall.), by H. N. Worthley (pp. 31–33) and the California red scale (*Aonidiella aurantii*, Mask.), by H. R. Yust and F. Munger (pp. 34–35) ; Rearing Insects that attack Stored Products, by H. H. Shepard (pp. 36–51), supplemented by contributions on secondary grain insects, by A. W. Buzicky (p. 52), the black carpet beetle (*Attagenus piceus*, Ol.), by F. W. Fletcher and E. E. Kenaga (pp. 52–53), the webbing clothes moth (*Tineola bisselliella*, Humm.), by A. H. Goddin (pp. 53–54), stored food insects, by H. E. Gray (pp. 54–56), the rice weevil, *Calandra* (*Sitophilus*) *oryzae*, L., by A. L. Hamner (p. 56), a basic diet, by M. H. Haydak (p. 56), termites, by R. E. Hungate (pp. 56–58), book lice (*Liposcelis divinatorius*, Mull.), by E. L. Sheehan (p. 58), collecting eggs of the bean weevil, *Bruchus* (*Acanthoscelides*) *obtectus*,

Say, by H. W. Smith (pp. 58–59) and trapping and rearing the firebrat (*Thermobia domestica*, Pack.), by H. L. Sweetman (p. 59) ; and Rearing Insects affecting Man and Animals, by E. N. Woodbury (pp. 60–73), supplemented by contributions on the house-fly (*Musca domestica*, L.), by E. Bickoff (p. 74), the house-fly and stable fly (*Stomoxys calcitrans*, L.), by C. Eagleson (pp. 74–78), ticks, by C. N. Smith and M. M. Cole (pp. 78–80), and dog and cat fleas (*Ctenocephalides canis*, Curt., and *C. felis*, Bch.), by C. E. Venard (pp. 80–81).

Those dealing with methods of testing insecticides against insects in the laboratory comprise : Exploring the insecticidal Possibilities of new Materials, by M. C. Swingle (pp. 82–84) ; Testing Stomach Insecticides, by R. Hansberry (pp. 85–94), supplemented by contributions on ant baits, by S. C. Billings (p. 95), histological techniques, by F. H. Butt (pp. 95–96), larvicides for the codling moth, *Cydia* (*Carpocapsa*) *pomonella*, L., by L. P. Harris and H. A. Waters (pp. 96–98), grasshopper baits, by E. J. Hinman (p. 99), spray suspensions, by E. R. McGovran and E. L. Mayer (pp. 99–102), English and European methods, by J. T. Martin (pp. 102–104), analysis for insecticides in insect tissues, by L. B. Norton (pp. 104–107), tests against the Mexican fruit-fly (*Anastrepha ludens*, Lw.), by C. C. Plummer (pp. 107–111), tests against leaf-eating larvae, by S. F. Potts (pp. 111–114), tests against newly-hatched larvae of the European corn borer (*Pyrausta nubilalis*, Hb.), by D. D. Questel (pp. 114–115), general methods and equipment, by H. A. Waters (pp. 115–123), and testing phytotoxic and adhesive properties, by H. A. Waters (pp. 123–125) ; Testing Contact Insecticides, by C. H. Richardson (pp. 126–135), supplemented by contributions on livestock sprays, by C. Eagleson (pp. 136–138), a dusting chamber, by J. H. Pepper and E. Hastings (pp. 138–140), and a drop test, by H. N. Worthley (pp. 140–143) ; Testing Fumigants, by R. T. Cotton (pp. 144–151), supplemented by contributions on the application of ampules, by R. N. Jefferson and J. M. Grayson (pp. 152–154), and tests against the California red scale, by H. R. Yust and L. B. Howard (pp. 154–156) ; Making and testing Aerosols, by L. D. Goodhue and W. N. Sullivan (pp. 157–162) ; Testing Fabric Protectors, by F. W. Fletcher (pp. 163–164) ; Testing Soil Treatments for Termite Control, by W. E. McCauley (pp. 165–166) ; and Testing Attractants and Repellents, by V. G. Dethier (pp. 167–172), supplemented by contributions on the evaluation of blowfly repellents, by E. S. Loeffler and W. M. Hoskins (p. 173), dry-cleaning fluid as an attractant for the kelp fly (*Coelopa frigida*, F.), by C. M. Williams (p. 174) and the repellency of organic compounds to the Mexican bean beetle (*Epilachna varivestis*, Muls.), by E. N. Woodbury (pp. 174–176).

The last paper of the symposium, by F. M. Wadley (pp. 177–188), deals with statistical aspects of laboratory tests of insecticides, and indices to the scientific and popular names of the numerous insects discussed are appended.

ELMORE (J. C.) & HOWLAND (A. F.). **Life History and Control of the Tomato Pinworm.**—*Tech. Bull. U.S. Dep. Agric.* no. 841, 30 pp., 8 figs., 23 refs. Washington, D.C., 1943.

The tomato pinworm, *Keiferia* (*Phthorimaea*) *lycopersicella*, Busck, is known to occur in nine of the United States and in Hawaii, Haiti, Mexico and Peru, and has been intercepted in tomatos from the Bahamas and Cuba. It formerly caused heavy losses of both early and late crops in southern California, but has been confined principally to late canning and market crops since about 1936. Its principal food-plants are tomato and potato ; it has been recorded on potato in California, Virginia and Mexico, but has seldom caused much damage to it. Details are given of its bionomics in California and the nature of the injury it causes [*cf. R.A.E.*, A **25** 621], and all stages are described. Oviposition on the leaves of young tomato plants begins in March and April ; the eggs are laid principally on the upper half of the plant and during the first two days after emergence. Pupation normally occurs at or near the surface of the soil, and

moths cannot emerge normally if buried two or more inches deep. The ratio of males to females was usually about 45 : 55 ; at mean temperatures ranging from 76 to 80°F., the moths lived for an average of 7 days when supplied with water only and 8½ days if given 10 per cent. honey solution.

Parasites have been an important factor causing the decrease in abundance in California since 1936. Of 342 larvae allowed to pupate during November and December 1935, 16 per cent. were parasitised ; the parasites determined were *Apanteles scutellaris*, Mues., *Sympiesis stigmatipennis*, Gir., *Chelonus phthorimaeae*, Gah., *Omorgus* (*Campoplex*) *phthorimaeae*, Cushm., and an undescribed species of *Angitia*. Other species reared from larvae collected in various localities in California were *Parahormius* (*Hormius*) *pallidipes*, Ashm., *Angitia ferrugineipes*, Ashm., *Apanteles dignus*, Mues., and *Tetrastichus* sp. *Catolaccus aeneoviridis*, Gir., *Zatropis* sp. and *Chrysocharis* sp. emerged from collections of tomato leaf folds. Examination in two fields in October 1936 showed that 41 per cent. of the larvae in leaf folds were parasitised, and that parasitism of larvae in the fruit was common.

The transport of infested fruit, seedling plants or packing boxes and the flight of the moths, particularly from plants that are left in the field after the last picking or cut or pulled after harvest and piled along the edge of the field to make way for a second crop, are the most important means of dissemination. Seedbeds and propagating houses may be a reservoir of infestation in winter. Cultural practices, such as destroying plant remnants and ploughing the fields as soon as the crop is harvested, are important control measures [*cf.* **28** 575]. In extensive laboratory and field experiments in 1926–41 with contact and stomach insecticides in dusts and sprays, cryolite and cuprous cyanide dusts were the most effective [*cf. loc. cit.*], and it is recommended that cryolite diluted with talc to contain 70 per cent. sodium fluoaluminate should be applied four times at the rate of 20–25 lb. per acre at intervals of 10 days, beginning when the first fruit is about an inch in diameter and finishing after the first market picking. Young plants should be dusted in the seedbed or soon after they are transplanted if the pinworm is abundant or if heavy damage is expected.

Tauber (O. E.), Tauber (A. H.), Bruce (W. N.) & Griffiths jr. (J. T.). **Effect on the Chinch Bug** (*Blissus leucopterus* **Say**) **of Contact with various Dinitrophenols and other Dusts.**—*Iowa St. Coll. J. Sci.* **18** no. 2 pp. 255–265, 5 refs. Ames, Iowa, 1944.

Investigations were carried out in Iowa in 1942 on the effect of dinitrophenols and other dusts on *Blissus leucopterus*, Say, by allowing the bugs to crawl across a flat dust barrier, 1 inch wide, applied on a smooth surface at rates equivalent to about 70 lb. per acre, and recording the percentages dead after 2–48 hours. The dusts other than dinitro compounds were not promising.

The following is substantially the authors' summary. Under laboratory conditions of uncontrolled temperature and humidity, chinch bugs, especially the younger instars, are considerably debilitated by dehydration and starvation. Bugs so weakened after exposure to the dust are much more affected by contact with dinitro-o-cresol than those with access to food after exposure. When dinitro-o-cresol is diluted with 320-mesh sulphur, the mixture is more toxic than equal concentrations with proprietary pyrophyllites as diluents. Sulphur mixtures seemed to adhere better to the insect. Up to concentrations of about 8 per cent., impregnation of the diluent with dinitro-o-cresol in liquid form increases the toxicity of the mixture over that of the same concentration freshly mixed with ingredients in a dry state. Putting the toxic agent into solution simply gives a chance for more thorough molecular dispersal throughout the diluent. Impregnation is perhaps of value only in mixing dusts with a low content of the dinitro-cresol. With higher concentrations, mechanical mixing of dry ingredients can be sufficient. With some dinitro compounds, sublimation

of the poison may contribute to the dispersal of the toxic agent through the dry diluent. Unless special care is taken with dinitrophenol dusts containing oil, the oiled mixtures will tend to clump into aggregates that are too heavy to lodge securely on the surface of the bug. The oil makes the mixture somewhat sticky and, with proper precautions in the preparation and use of a fresh, fluffy barrier, the addition of oil increases adherence of the dust. When clumping occurs, this advantage is largely lost. This point might be especially true under field conditions, when larger aggregates of the oiled dust would be more easily dislodged by brushing against clods or plants. Dinitro-o-secondary-butyl-phenol was the most toxic of the dusts tested with large samples of bugs. A 4 per cent. mixture in pyrophyllite killed all adults and fifth-instar nymphs within 19 hours. Dinitro-o-cresol and dinitro-o-cyclohexylphenol were about equally effective at some levels of concentration. At 8 per cent. in pyrophyllite the former killed all adults in 19 hours, and the latter in 21 hours. Dinitro-o-cyclohexylphenol is slower in beginning to show its lethal properties, especially at lower concentrations. Preliminary tests on small samples seemed to indicate that ammonium dinitro-o-cresylate is extremely toxic to the chinch bug, since at a concentration of 8 per cent. in pyrophyllite, it gave complete mortality of adults in 2 hours.

HORSFALL (W. R.). **Biology and Control of Common Blister Beetles in Arkansas.** —*Bull. Ark. agric. Exp. Sta.* no. 436, 55 pp., 11 figs., 17 refs. Fayetteville, Ark., 1943.

Owing to an increase in the abundance of grasshoppers and changes in cropping practices, certain species of Meloids have increased in numbers in Arkansas during the last 10 years and more effective methods of controlling them are required. The larvae are not considered of great value in grasshopper control; it is estimated that they do not destroy more than 24 per cent. of the eggs of the more injurious grasshoppers even under optimum conditions. A general account is given of the life-history of these beetles, together with notes on the morphology of the various stages, the distribution in the United States and the bionomics, based on observations in Arkansas in recent years, of seven common species. The results with respect to *Epicauta pennsylvanica*, Deg., and *Henous confertus*, Say, have already been noticed [*R.A.E.*, A **29** 566; **31** 62]. *E. pennsylvanica* is not a pest of crops, though it sometimes feeds on the flowers of lucerne [*cf.* also **29** 361].

Adults of *H. confertus*, *Macrobasis fabricii*, Lec., and *E. lemniscata*, F., are present in Arkansas from the middle or end of May until October, those of *E. marginata*, F., from mid-June until September, those of *E. funebris*, Horn, and *E. cinerea*, Forst., from August until October, and those of *E. pennsylvanica* from August until November. Their bionomics are correlated with those of the differential grasshopper [*Melanoplus differentialis*, Thos.] and the two-striped grasshopper [*M. bivittatus*, Say], which oviposit from late August until the frosts and in late July and August, respectively, but the correlation is less marked in the case of *H. confertus*. *E. lemniscata* is the most harmful species in Arkansas, where it is common in the lucerne-growing areas in the north. The adults attack and often defoliate several crops, of which tomato, potato, beans, soy beans and lucerne [*cf.* **31** 111] are preferred; lucerne also favours the increase of grasshoppers, and outbreaks of *E. lemniscata* are therefore especially frequent where it is grown. The adults are gregarious, and in 1941 at least one egg mass was found in every 100 sq. ft. of an area on which a swarm had fed. The egg masses were found to contain 97–204 eggs; they hatched in 10–19 days in field cages at 70°F. and in 14–16 days in the laboratory at 81°F. Though the larvae prefer eggs of *M. differentialis* and *M. bivittatus*, some were present in the field about mid-July and must therefore feed on eggs of the smaller species of *Melanoplus*, *Chortophaga*, and other pasture grasshoppers.

The five feeding instars are all of short duration, but larvae that do not reach the fifth until October may remain in it until the spring. Many of the larvae pupate directly after the fifth instar, omitting the two supernumerary instars characteristic of blister beetles [**29** 567], especially when they have been reared at high temperatures. Two or possibly more years may be passed in the inactive sixth instar, but the seventh is of short duration. In field cages, the pupal stage lasted about 12 days. One complete and a partial second generation occurred during the year. The adults are most abundant in late July; those from larvae that have not overwintered or have overwintered in the fifth instar appear during the middle and latter part of August or later.

E. marginata is most injurious where autumn potatoes are grown and frequently defoliates *Clematis* in the north-western part of the State; other ornamental and crop plants are also attacked. Although the adults appear in mid-June, eggs are not laid until late July and August; the masses contained 153–349. The larvae hatched in about 26 days and began to feed towards the end of August. All the larvae overwintered in the sixth instar and passed into the seventh instar at about the same time in spring, regardless of the date on which they had entered the sixth. Larvae in field cages consumed 42–45 grasshopper eggs during their development, so that two or three might develop from a single egg pod of *M. differentialis*. The pupal stage lasted 14–15 days. Adults were most numerous during late July or early August, and only one generation occurred in the year.

E. funebris sometimes defoliates tomatos, on which it became an important pest in 1940, and also attacks potatoes, on which it is responsible for damage hitherto ascribed to *E. pennsylvanica*, *Clematis* and wild plants, including ground-cherry (*Physalis*), *Actinomeris* sp. and *Silphium* sp. The peak of oviposition occurred in late August and early September, and the egg masses contained 127–316 eggs, which hatched in 24–35 days at 73–78°F. The larvae completed the five feeding instars in 15–18 days at 80°F., but required 25–34 days under field conditions where the temperature averaged 70°F. Larvae that began to feed late in the season overwintered in one of the feeding instars and continued to develop during the winter at temperatures above 45°F., but mortality among them was high. The duration of the sixth instar varied from a few days to more than two years, but the seventh instar lasted only 6–14 days, and most of the larvae pupated at about the same date in summer, regardless of the date on which their development had begun in the previous year. They consumed 41–45 grasshopper eggs during development. The pupal stage lasted 12–24 days under field conditions, and only one generation was observed in the year.

E. cinerea feeds principally on horse nettle [*Solanum carolinense*] and *Physalis*, but has been collected on tomato and is a potential pests of solanaceous crops in north-western Arkansas. Oviposition was completed in September, the number of eggs in a mass varying from 117 to 324, and hatching probably extends from late September throughout October. The larvae fed on the eggs of *M. differentialis* in autumn; most of them overwintered in the sixth instar, but some did not reach it until the following year and continued to feed during the winter when the temperature exceeded 45°F. The duration of the sixth instar varied according to when it began, and all the larvae entered the seventh instar, and later pupated at about the same time. The pupal stage lasted 14–16 days.

Macrobasis fabricii is common in districts in which lucerne and soy beans are grown, and is sometimes so abundant as to cause severe injury. It feeds chiefly on the flowers, but also readily attacks the leaves. The eggs are laid in late June and July in masses of 56–335; they are commonly deposited in undisturbed soil such as occurs in lucerne fields. Eggs kept in the laboratory at about 75°F. and in the field at a mean temperature of 76°F. hatched in 65–87 and 53–100 days, respectively. Supernumerary instars always occur, and the winter is generally passed in the sixth instar, which is resistant to prolonged

desiccation and cold and may last for two or more years. Some larvae overwinter in the fifth instar, however. Sixth-instar larvae kept in field cages exposed to variable temperatures moulted to the seventh instar in April or May, but those kept at laboratory or incubator temperatures remained in this stage indefinitely. A larva consumed 29–45 eggs during its development. The pupal stage lasted 9–14 days in field cages at about 72°F., and there was only one generation a year. Adults were most abundant in late June.

Direct control methods are difficult to apply effectively and should be used only as an emergency measure. The importance of the beetles can be reduced by controlling *M. differentialis* and *M. bivittatus*, and much damage could be prevented even if this were done only on single farms, since the adults of all the species except *E. lemniscata* travel only short distances. Dusts of finely-ground barium or sodium fluosilicate have given satisfactory control when directed at the beetles, which ingest them while cleaning themselves, but were less effective when applied to the plants. A strip surrounding the area occupied by the beetles should first be dusted before thoroughly treating the infested area ; the economic practicability of the measure depends on the extent of infestation and the value of the crop. Barium fluosilicate did not injure beans, beet and tomatos ; sodium fluosilicate diluted with an equal part of hydrated lime [**14** 12] at times injured cucurbits and tomatos, but not soy beans or lucerne. A mixture of equal parts of sodium fluosilicate and talc gives good control. Rotenone dusts are recommended only against *E. lemniscata* on leafy vegetables, tomatos and beans near harvest, since the swarms occupy a relatively small area, and a heavy application can be made at a low cost [*cf.* **31** 111]. A light-trap operated near an infestation of *E. lemniscata* and *E. marginata* in the summer of 1941 attracted large numbers of the former.

NEISWANDER (R. B.) & BLACKBURN (N. D.). **Recent Developments in Peach Insect Control.**—*Proc. Ohio hort. Soc.* **76** pp. 59–71. Columbus, Ohio, 1943.

Damage to peach in Ohio by the oriental fruit moth [*Cydia molesta*, Busck] has not been severe in recent years. Stocks of the larval parasite, *Macrocentrus ancylivorus*, Rohw., have been reared during the past five years, and a total of 162,022 individuals have been released, 32,510 of them in 1942. None of the 17 foreign parasites released in Ohio appears to afford any control. Despite a light crop in 1942, there was no significant increase in damage, and this is attributed to the liberation of *M. ancylivorus*. Strawberry plantings infested by the strawberry leaf-roller [*Ancylis comptana*, Froel.] provide alternative hosts in which populations of this parasite can overwinter ; where both hosts are available, *C. molesta* is preferred. In one area where *A. comptana* was sufficiently numerous to damage the strawberry crop, injury to peaches by *C. molesta* became unimportant following the introduction of *M. ancylivorus*, enough parasites being maintained on *A. comptana* to keep up a high population level. Supplementary control measures comprise screening the packing houses and keeping used baskets in them until about 1st August, and when new orchards are planted, avoiding sites near apple orchards and varieties that ripen later than Elberta, since apples and late peaches are infested after the earlier peaches are harvested and are the source of a large hibernating population. It has been suggested that pruning and the application of fertilisers late in the season should be avoided, as the resulting stimulation of twig growth favours the increase of twig-feeding larvae, but as these are often heavily parasitised in August, it may also result in an increase in parasite populations.

The plum curculio [*Conotrachelus nenuphar*, Hbst.] has only one generation a year in Ohio and infests only early varieties of peach. Infested fruits fall early in June, and damage is most important when the crop is light. It has

increased in recent years, and an attempt was made in 1942 to improve the control measures now in use. The best control (82·6 per cent.) was given when the standard spray containing 2 lb. lead arsenate, 1 lb. zinc sulphate and 2 lb. lime per 100 U.S. gals., applied at sepal-fall, was preceded by a similar application at petal-fall; the effectiveness of the early spray was possibly due to warm weather during April and May, which caused the overwintered adults to appear earlier than usual. The next most effective treatments (67·9 and 62·6 per cent. control) were one application at sepal-fall and another two weeks later, and one of a single petal-fall application in which the quantity of each ingredient was increased by 1 lb. per 100 U.S. gals. The standard schedule gave only 43·2 per cent. control, and one comprising two applications, made at sepal-fall and two weeks later, of a spray in which zinc sulphate was omitted and the amount of lime increased to 4 lb. gave only about 10 per cent. control and severely scorched the foliage. The crop from trees that received the most effective treatment was no larger than that from untreated trees, however, since it was heavy enough to require thinning after most of the infested fruits had fallen and the few remaining on the trees were removed during the process. It may therefore be safe to omit the lead-arsenate spray when the set of fruit is heavy, provided that the orchard does not adjoin woodland, apple orchards, lucerne fields or a wide fence row, all of which provide hibernation quarters for the weevil. Larvae were four times as numerous on trees bordering a neglected apple orchard than on those farther in the interior of the block, and nearly three times as numerous on trees bordering a lucerne field; spraying might therefore be restricted to the outermost rows of the orchard, or an extra application might be made there. Many larvae and pupae can be destroyed by the frequent cultivation of the soil during July, but collecting and destroying the adults in May and the fallen fruit in June involves too much labour to be practicable under present conditions.

In tests over a period of five years, paradichlorbenzene and ethylene-dichloride emulsion both gave excellent results against the peach tree borer [*Aegeria exitiosa*, Say] and caused little injury, even when used at high dosages and on young trees. In one orchard in which ethylene-dichloride emulsion was applied at the beginning of April, however, 15 per cent. of the young trees coming into bearing were dead and the inner bark at the base of the trees found to be brown by the end of June, and in another in which it was applied in the autumns of 1939 and 1940, spots appeared on the foliage in June 1941 and some leaves fell, though only a few trees died. Similar symptoms appeared in 1942, but a number of the unhealthy trees developed new leaves by August and appeared to be recovering; the inner bark at the base of injured trees was brown and in some cases there was also a constriction there. This occasional injury following the use of ethylene dichloride may be caused by unusual weather or types of soil, and this material should not be applied during unusually warm weather [*cf.* *R.A.E.*, A **32** 55]. In limited tests, a commercial preparation (Parascalecide) containing paradichlorbenzene dissolved in Scalecide appeared promising for use on nursery trees. Dissatisfaction with the treatment [**25** 372] recommended against the lesser peach borer [*A. pictipes*, G. & R.] has been found to be due to the confusion of the injury due to peach canker with that associated with *A. pictipes*; both cause exudations of resin, that due to *A. pictipes* containing frass. Raw linseed oil or miscible oil can be substituted for cottonseed oil as a solvent for paradichlorbenzene. Damage by the tarnished plant bug [*Lygus oblineatus*, Say] can be reduced by cultivating the orchard before the flowering period or, where this cannot be done, by removing the tall weeds and leguminous plants on which *L. oblineatus* feeds. The green soldier bug [*Acrosternum hilare*, Say] is present in the orchards from late May or early June until late September; the only measures known against it are clean cultivation or frequent mowing of the grass in the orchards. It is not injurious after severe winters.

WOODSIDE (A. M.). **Supplementary Control Measures for Codling Moth.**—*Bull. Virginia agric. Exp. Sta.* no. 342, 19 pp., 5 figs., 5 refs. Blacksburg, Va., 1942. [Recd. 1944.]

Since the control of the codling moth [*Cydia pomonella*, L.] on apple by spraying becomes increasingly difficult as the orchard becomes older, the author gives recommendations for subsequent supplementary measures for use in Virginia, together with details of the experiments on which they are based. They include packing-shed and general orchard sanitation, pruning, scraping of the trees and treatment or removal of decayed places, and the use of bands and bait-traps. It was found that large numbers of moths emerge in the packing sheds, and a tightly constructed building traps most of them. Many emerge from crates and these should be sterilised by one minute's immersion in boiling water, which kills the larvae in their cocoons, or stored in a room from which the moths cannot escape. Apples discarded at packing time, which contain most of the larvae, infested dropped fruits, and those that appear defective at thinning time should be collected and boiled for three minutes or buried under a foot of well tamped soil; in the latter case, the addition of 1 oz. paradichlorbenzene per bushel will help to destroy the larvae. Very few larvae were found to live through the winter on the ground in Virginia [*cf. R.A.E.*, A **30** 190], except in discarded materials such as are left round packing sheds and spray filling stations, but many survived on prop poles, which should be stacked outside the orchard and can be covered with cheesecloth as an additional precaution. Most of the hibernating larvae occur on the trees and can be killed by scraping off the rough bark and burning it during winter, covering any cavities or dead areas with 12-mesh screen wire or filling them with cement, removing split branches and burning prunings.

Tree bands, which should be in place by 1st June in southern Virginia and 10th–15th June in the rest of the State, reduce heavy infestations by up to 35–50 per cent.; they should carry a chemical coating of not less than $6\frac{1}{4}$ lb. per 250 ft. of 2-in. band [*cf.* **26** 507]. Bait-traps are useful for determining when the moths are flying, in order to ascertain the dates for applying cover sprays, and should be installed between 15th April and 1st May in the south of the State and between 25th April and 15th May in the centre and north. They are also effective in reducing heavy infestation by trapping the moths before they oviposit, and reduced injury in 1939–41 by about 50 per cent. when used at the rate of 1 per tree. The bait consisted of stock syrup (low grade molasses) and water (1 : 20) with the addition of 1 cc. anethol, emulsified with bentonite, per U.S. quart [*cf.* **28** 148]. The traps should be refilled before the flight of first-generation moths and again before that of the second generation if one occurs. When light-traps consisting of a lamp surrounded by an electrocuting grid were tested in New York [*cf.* **25** 687], they gave control equivalent to that obtained from two cover sprays of lead arsenate, but were very much more expensive and are not recommended for general use.

HOPPING (G. R.), LEECH (H. B.) & MORGAN (C. V. G.). **The Larch Sawfly, *Pristiphora erichsonii* (Hartig) in British Columbia, with special Reference to the Cocoon Parasites *Mesoleius tenthredinis* Morley and *Tritneptis klugii* (Ratzeburg).**—*Sci. Agric.* **24** no. 2 pp. 53–63, 1 map, 10 refs. Ottawa, 1943.

A brief account is given of the westward spread of the larch sawfly, *Pristiphora* (*Lygaeonematus*) *erichsoni*, Htg., across Canada [*cf. R.A.E.*, A **24** 245]. It was observed in British Columbia for the first time about 1930, though it was not officially known to be present until 1933 [*cf.* **24** 246], on western larch (*Larix occidentalis*) near Fernie, and by 1942 had reached the Okanagan Valley [**32** 22], which is approximately the western limit of *L. occidentalis.* Its

present distribution in the Province is shown on a map. It was accompanied on its western spread by the Pteromalid parasite, *Tritneptis klugi*, Ratz. (*Coelopisthia nematicida*, Pack.) [*cf.* **24** 246], and the Ichneumonid, *Mesoleius tenthredinis*, Morl., was released against it in the Fernie area in 1934 and in other localities in later years [*cf. loc. cit.*], 2,572 males and 2,167 females being liberated up to 1942. The dates, localities and numbers released are shown in a table. Investigations on the abundance and interactions of these parasites were made in 1934–42 by means of collections of large numbers of sawfly cocoons, chiefly in the Fernie district, and in 1940–42 by collections from permanent sample plots, the situation of which is shown on a map. The sampling technique is described. The results, which are given in tables, indicated that both parasites are well distributed over the infested areas and are of considerable importance in controlling the sawfly. It was found at Fernie in 1935 that *M. tenthredinis* was sometimes parasitised by *T. klugi* [*cf.* **29** 552], the maximum degree of hyperparasitism being 59 out of 156 examples of the Ichneumonid in a sample of 2,081 cocoons. Hyperparasitism was also observed in 1936 and 1942. Since *M. tenthredinis* gave 88 per cent. parasitism in 1927 in Manitoba [**16** 450], where *T. klugi* was apparently absent, it is possibly inadvisable to introduce the latter into areas containing the former. *M. tenthredinis* may, however, be introduced with advantage into areas in which *T. klugi* is present, since the percentage parasitism by *T. klugi* alone did not exceed 50 in the mass samples, while that by the two parasites together exceeded 70 in several areas.

The annual number of generations of *T. klugi* was investigated in 1941. Adults emerged between 5th and 25th June from cocoons collected in the autumn of 1940, and those of the two subsequent generations on 12th–25th July and 11th–19th August. Adults of the last oviposited but no further emergence occurred in 1941. The average numbers that emerged per cocoon were 35, 65·8 and 45, respectively. Three generations a year are therefore possible in British Columbia, though the summer broods may be limited by scarcity of full cocoons between the emergence of adults and the time when new cocoons are formed. New cocoons are, however, present in some years before the peak of sawfly emergence, while old cocoons are still available. There are also usually some cocoons containing larvae in diapause. In mass samples of cocoons from 5 localities near Fernie in 1935, 0·64–22·2 per cent. contained diapausing individuals. The shortest period required for completion of a summer generation of the parasite was 29 days. The percentage of males in the three generations varied from 13 to 15. Females can reproduce parthenogenetically, but in such cases all the progeny are male [**28** 417]. *T. klugi* parasitised larvae, pupae and even teneral adults of *M. tenthredinis*, but the number of examples per cocoon was smaller than when the sawfly was the host.

P. erichsoni was also parasitised in the Fernie region by *Ptychomyia* (*Bessa*) *selecta*, Mg., which was fairly common in 1934 and 1935 but comparatively scarce afterwards. This Tachinid apparently prefers to oviposit in third- and fourth-instar larvae. Up to six, but usually only one or two, eggs were found on a single host. It was liberated in two further areas. Two examples of *Phorocera* sp. were also reared from the sawfly. In 1935, 872 adults of the Japanese Tachinid, *Zenillia nox*, Hall [**25** 563] were released in two localities, but it was not recovered.

The fungus, *Isaria farinosa*, was present in each of the years during which collections were made, but though it infested over 70 per cent. of the sawfly cocoons in one area in the spring of 1936, the mortality due to it could not be accurately estimated since it usually invades cocoons in which the larvae have been killed by freezing and temperatures during the preceding winter had been low. There is some evidence, however, that it may be a primary cause of mortality. In 1934 it spread to apparently healthy cocoons after collection, and it may be valuable under certain conditions of moisture. Mortality from small mammals is also difficult to assess, since cocoons opened by them may

have contained dead or parasitised sawfly larvae. Predators, which appear to be less important as control factors than parasites, also included wasps, the larvae of the Elaterid, *Ludius lutescens*, Fall, and a bird (*Turdus planesticus*).

Yearly records of defoliation on the sample plots and observations on the general sawfly infestation indicated that defoliation has been heavy during the first few years after the sawfly has become established in an area but has subsequently decreased. In view of the natural control factors now operating over much of the infested area of British Columbia, it is possible that the sawfly population will be sufficiently reduced to prevent any lasting damage to stands of western larch.

McGuffin (W. C.). **New Descriptions of Larvae of Forest Insects, VI,** *Semiothisa, Paraphia; Protoboarmia* **(Lepidoptera, Geometridae).**—*Canad. Ent.* **75** no. 7 pp. 134–138, 6 figs. Guelph, Ont., 1943. **VII,** *Pero, Nepytia, Caripeta* **(Lepidoptera, Geometridae).**—*T.c.* no. 10 pp. 186–190, 6 figs., 1 ref.

The species dealt with in these parts of a series of descriptions of the larvae of Canadian forest insects [*cf. R.A.E.*, A **31** 173] are *Semiothisa granitata*, Gn., *Paraphia piniata*, Pack., *Protoboarmia porcelaria*, Gn., *Pero morrisonarius*, Edw., *Nepytia canosaria*, Wlk., and *Caripeta divisata*, Wlk. They all feed on conifers of several genera. *Paraphia piniata* and *N. canosaria* also feed on white birch [*Betula papyrifera*], and *Protoboarmia porcelaria* on poplar, yellow birch [*B. lutea*] and oak.

Hall (J. A.). **Notes on the Dogwood Fly, a Race of** *Rhagoletis pomonella* **(Walsh).**—*Canad. Ent.* **75** no. 11 p. 202. Guelph, Ont., 1943.

The view that the form of *Rhagoletis pomonella*, Walsh, infesting dogwood (*Cornus amomum*) represents a race biologically distinct from the typical form infesting hawthorn [*Crataegus*] and apple [*R.A.E.*, A **28** 421] was confirmed by investigations in Ontario in 1939–42, when cross-breeding experiments were made and the food-plant relationships of flies reared from *Cornus* were studied. The newly-emerged flies were confined in cages containing potted *Cornus* seedlings, water, and a mixture of sugar, yeast and proteose-peptone (4 : 1 : 1) and, in the field, in cages enclosing branches, with or without fruit, of *Cornus*, apple or hawthorn. Flies reared from *Cornus* mated readily in the cages and deposited large numbers of fertile eggs in *Cornus* fruit, but not in apples or haws. When males or females from *Cornus* were confined with females or males reared from apple or hawthorn, mating was never observed and no fertile eggs were laid, although fruits of all three plants were supplied.

Atwood (C. E.). **A third Tent Caterpillar in eastern Canada (Lepidoptera, Lasiocampidae).**—*Canad. Ent.* **75** no. 11 pp. 203–205, 3 figs. Guelph, Ont., 1943.

Malacosoma pluvialis, Dyar, which has been known in western Canada for many years, has recently become common in parts of Ontario and Quebec. The preferred food-plants are wild red cherry (*Prunus pennsylvanica*), white birch (*Betula papyrifera*), and a small willow associated with them ; other shrubs are occasionally attacked. The eggs are deposited almost solely on cherry, though a few were observed on birch. Trees 4–6 ft. high, and growing in unshaded and uncrowded situations, such as occur in coppice growth along roads, etc., are preferred for oviposition, and few eggs were found on trees forming part of the dense regrowth following forest fires, where cherry is a common species. The egg-masses, which often contain about 100 eggs, are laid about one foot from the ground and do not encircle the twigs, as do those of *M. disstria*, Hb., and *M. americana*, F. The larvae hatch when the leaves of the

food-plant are unfolding and spin a succession of silken shelters in which they feed gregariously. When nearly full-grown, they wander over neighbouring bushes, still feeding, before spinning their cocoons, which were found under dead roots and pieces of stumps. The adults emerged in mid-July at the place in Quebec where observations were made; both this species and *M. disstria* were numerous there in 1939 and 1940 and very scarce in 1941–42. It is probable that the situation of the cocoons protects them from *Sarcophaga aldrichi*, Park., one of the most important parasites of *M. disstria*, but renders them more subject to attack by terrestrial predators. In 1940, half the egg-masses observed had been damaged by mice or shrews.

Fox (W. B.). **Some Insects infesting the "Selenium Indicator" Vetches in Saskatchewan.**—*Canad. Ent.* **75** no. 11 pp. 206–207, 11 refs. Guelph, Ont., 1943.

Lists are given of insects observed breeding on or associated with two milk vetches, *Cnemidophacos pectinatus* and *Diholcos bisulcatus*, which occur commonly on selenium-bearing soils in Saskatchewan and are regarded as selenium indicators. The roots and foliage of *C. pectinatus* have been found to contain selenium to the extent of 57·5–969 and 162–4,190 parts per million, respectively, and the foliage of *D. bisulcatus* may contain as much as 3,640 p.p.m. The roots of both species were infested by the Cerambycid, *Anoplodera instabilis*, Hald., and the Tineid, *Walshia amorphella*, Clem., neither of which was found breeding on other vetches, even though these were in close proximity. *A. instabilis* has been recorded from pines, however, and *W. amorphella* from false indigo [*Amorpha*]. Larvae of *A. instabilis* occurred on roots of *C. pectinatus* containing 154–969 p.p.m. selenium, and the selenium content of roots of uninfested *C. pectinatus* growing close to infested plants with a high content was found to be only 57·95 p.p.m. The other insects that fed on the plants included larvae of *Corymbites* (*Ludius*) *aeripennis destructor*, Brown, *Drasterius* (*Aeolus*) *mellillus*, Say, and *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., on the roots of *C. pectinatus*, adults of three Meloids on the foliage of both species, and *Bruchus seminulum*, Horn, and a Eurytomid closely related to *Bruchophagus gibbus*, Boh., in the seeds of both.

Brown (A. W. A.) & MacKay (M. R.). **The Jack Pine Budworm and the Spruce Budworm,** *Cacoecia fumiferana* **Clem. (Tortricidae).**—*Canad. Ent.* **75** no. 11 pp. 207–211, 4 figs., 1 ref. Guelph, Ont., 1943.

The authors state that differences in size, wing coloration, male genitalia (width of uncus), geographical distribution, food-plant relationships and seasonal history indicate that the form of *Harmologa* (*Cacoecia*) *fumiferana*, Clem., that attacks jack pine [*Pinus banksiana*] in North America ranks at least as a subspecies of that on spruce and balsam fir [*Abies balsamea*]. The range of the former in Canada is limited to the interior, where it is most abundant in north-western Ontario and also occurs in other parts of Ontario, southern Manitoba and central Saskatchewan; it extends southwards to Michigan and Minnesota, and its frequency of occurrence is closely correlated with the abundance of the food-plant. The form that attacks spruce occurs from the Atlantic to the Pacific coast and extends southwards to Oregon and Pennsylvania and northwards almost to the timber limit. When larvae from jack pine in one locality in Ontario, spruce in another, and both in a third were reared together, those from jack pine were found to pupate and give rise to adults 2–3 weeks later than those from spruce. A few individuals of each form were collected from food-plants characteristic of the other, and these pupated and emerged on the same mean dates as members of the same form on the usual food-plant. The form that attacks jack pine was reared in small numbers from other hard

pines, white pine [*P. strobus*] and white and black spruce [*Picea glauca* and *P. mariana*]; the spruce form chiefly attacks spruces and firs [*Abies*], but considerable numbers sometimes occur on larch, eastern hemlock [*Tsuga canadensis*] in the Appalachian region, and Douglas fir [*Pseudotsuga taxifolia*] in the Pacific region, and local infestations have occurred on white pine, jack pine, and Scots and red pine [*Pinus sylvestris* and *P. resinosa*] in Ontario and on jack pine in Manitoba.

DEL CAÑIZO (J.). **Spain. Control of *Aelia rostrata* in Andalusia.**—*Int. Bull. Plant Prot.* **17** no. 1 p. 1M. Rome, 1943.

The marshy plains of the Guadalquivir, near Cadiz, form a permanent breeding ground for *Aelia rostrata*, Boh., which develops on wild plants and migrates to the neighbouring wheat fields [*cf. R.A.E.*, A **26** 697]. Owing to an alarming increase in infestation, experimental spraying with an aqueous solution of sodium cyanide (3½–4 parts per mille), applied by means of a long tube with a finely pierced spray nozzle, was carried out in June 1942 in place of the former method of burning over infested plants [**26** 698]. The spray killed the nymphs as well as the adults and penetrated the cracks in the soil in which the insects shelter so that many of them escape destruction by fire.

Switzerland. Advance of the Colorado Beetle (*Leptinotarsa decemlineata*).—*Int. Bull. Plant Prot.* **17** no. 1 pp. 2M–6M. Rome, 1943.

Infestation by *Leptinotarsa decemlineata*, Say, in French Switzerland was, in general, more intense and widespread in the early part of 1942 than it had been in 1941 [*cf. R.A.E.*, A **31** 180], but it did not develop in so serious a manner as was expected. The number of infested communes and foci in German Switzerland was lower, and four cantons (Uri, Appenzell, Graubünden and Ticino) were free from attack. Emergence of overwintered adults was heavy in May in French Switzerland, and the weather was favourable in spring and early summer, but it was possible to give regular and timely treatment to infested fields under good conditions practically everywhere. Moreover, late planting of potatoes in many places produced a greater dispersion of the adults in search of food and thus weakened the intensity of local infestation, and the rapid growth of the plants, due to the warm weather, made them more resistant to attack. A more decided division than usual between the generations was noted. Adults of the overwintered generation had practically disappeared by mid-July, when first-generation adults began to emerge, and practically all the first-generation larvae had entered the soil by the end of the month. Dry weather retarded oviposition and made the development of the second-generation larvae irregular, but the larvae were locally injurious to late potatoes at the end of August. By 1st September, some were full grown, so that the production of a third generation seemed possible, but many adults had already entered the soil for hibernation.

CANDURA (G. S.). **Italy. Further Damage caused by the Indian Meal Moth** (*Plodia interpunctella*) **and the Angoumois Grain Moth** (*Sitotroga cerealella*).—*Int. Bull. Plant Prot.* **17** no. 2 pp. 19M–20M. Rome, 1943.

Larvae attacking fresh apples and pears in a warehouse at Bolzano were identified as *Plodia interpunctella*, Hb. It was found that a single fruit might be attacked by several larvae and destroyed in a few days.

Sitotroga cerealella, Ol., completed 4–5 generations in a year in the south of Italy and 3–4 in the north in stored cereals, and also produced three generations in dried and hulled chestnuts and red beans and four in buckwheat. It was observed that a single larva may attack more than one grain of certain early

wheats. The females of the first generation laid an average of 150–160 eggs in the south and 100 in the north, the number of eggs deposited by successive generations usually decreasing by 15–20 per cent. or more. Dusting grain with 2–3 per cent. fossil farina [a mealy-looking infusorial or microphytal earth] was found to protect grain from attack and also to destroy the larvae if the grain was infested.

BENLLOCH (M.). **Spain. Control Measures for the Larvae of *Chironomus* and *Ephydra* in Rice-fields.**—*Int. Bull. Plant Prot.* **17** no. 3 p. 33M. Rome, 1943.

The author reports that in the last two years the larvae of a species of *Chironomus* and one of *Ephydra*, probably *E. macellaria*, Egger, have caused severe damage to rice seedlings in seed plots in the marshy plains of the Guadalquivir. Very satisfactory control was obtained by spraying the plants with dilute solutions of sodium cyanide, which did not injure the seedlings and rapidly destroyed the larvae. The seed plots are small enough to be sprayed with a portable sprayer from the edges.

HENDERSON (F. Y.). **The Depletion of Starch from the Sapwood of the Ash (*Fraxinus excelsior*) and its Relation to Attack by Powder-post Beetles (*Lyctus* spp.).**—*Ann. appl. Biol.* **30** no. 3 pp. 201–208, 13 refs. London, 1943.

An account is given of experiments carried out in 1932–39 to examine the physiology of the disappearance of starch from living sapwood of *Fraxinus excelsior* and to find whether the starch could be removed by physiological methods from felled timber on a commercial scale, in order to render it immune from attack by *Lyctus*. A study of the drift of starch, nitrogen and sugars during the respiration of living wood in the period between felling and depletion was also made to find how much, if at all, attack by *Lyctus* is limited by the depletion of substances other than starch.

The following is based on the author's summary. Observations on disks of timber kept under controlled conditions showed that depletion is conditioned by the access of oxygen ; thus, although it proceeds from without inwards in the standing tree, it can be induced in any part of the sapwood, and in any direction, by permitting access of oxygen. The optimum temperature range for depletion in ash is 31–36°C. [87·8–96·8°F.] ; above 45°C. [113°F.] the death of the cells may interrupt depletion. The presence of β-indolyl acetic acid does not influence the rate of depletion. Re-formation of the starch in the depleted wood in the presence of cane sugar could not be induced. The enzyme concerned in mobilisation of the starch appears to be a labile one with an optimum in the neighbourhood of 40°C. [104°F.] and to be produced during the active respiration of the cells, starch depletion ceasing when oxygen is withdrawn.

In transversely cut disks, the rate of respiration at 33°C. [91·4°F.] ceases to be proportional to the volume of tissue after a thickness of about 6 mm. has been attained. At 20°C. [68°F.], disks 10 mm. thick may be evenly depleted. Infestation experiments on timber undergoing depletion showed that the attack by *Lyctus* is circumscribed by starch-level and not by total nitrogen or soluble sugars ; no infestation occurred when the amount of starch fell to 1.54 per cent. or less of the oven-dry weight.

Under correct conditions of kilning, a one-inch sapwood plank can be rendered free of starch in about 20 days ; with larger sizes, depletion is uncertain and probably uneconomic.

The methods of starch and sugar analysis used in the work are described in an appendix by E. W. Bennison.

MORISON (G. D.). **Notes on Thysanoptera found on Flax** (*Linum usitatissimum* **L.**) **in the British Isles.**—*Ann. appl. Biol.* **30** no. 3 pp. 251–259, 37 refs. London, 1943.

The following is based on the author's summary. Brief descriptions are given of 18 species of Thysanoptera Terebrantia that have recently been found on flax in the British Isles, with notes on their life-histories and distribution. More species occur in the south than in the north of Great Britain, and species common to both regions are usually more abundant in the south. They breed on certain species of crop plants, weeds or trees of arable land and have not been proved to cause damage of economic importance to flax in this country ; the flax thrips, *Thrips lini*, Lad., has not been found. *Taeniothrips vulgatissimus*, Hal., sometimes breeds on flax, and adults of this species and of *T. atratus*, Hal., may cause superficial damage to the flower petals. *Thrips angusticeps*, Uzel, and *T. tabaci*, Lind., can probably breed on flax.

TATTERSFIELD (F.) & POTTER (C.). **Biological Methods of determining the insecticidal Values of Pyrethrum Preparations (particularly Extracts in heavy Oil).**—*Ann. appl. Biol.* **30** no. 3 pp. 259–279, 11 figs., 5 refs. London, 1943.

The development of a technique for the control of insect pests in houses and warehouses by means of pyrethrum extracts in heavy non-volatile petroleum oils, which act as direct contact sprays and also form a toxic film over which the insects crawl [*cf. R.A.E.*, A **27** 154], makes it important that pyrethrum preparations should comply with a specified standard and that a means of evaluating preparations should be available. As chemical assay alone does not always give a satisfactory estimate of toxicity, it is necessary to prepare a solution of pyrethrum extract in oil, the composition of which can be stated as completely as possible and which can be reproduced, and to develop a biological method of comparing unknown solutions with this standard. Techniques for measuring the toxicity of a preparation both as a direct spray and as a film were therefore developed and compared. Adults of *Tribolium castaneum*, Hbst., which were relatively easy to rear and fairly sensitive to the insecticides, were used as the test insect. Results would be more reliable if insects of several species were used, but this would involve difficulties in breeding large numbers under standard conditions and much time in repeating the tests.

The rearing and experimental conditions, including temperature, which appeared to have considerable effect on toxicity, and humidity, the action of which is not known, were standardised as far as possible, and handling was reduced to a minimum. The beetles were reared on fumigated wholemeal flour at approximately 27°C. [80·6°F.] and 60–70 per cent. relative humidity and used 1–2 weeks after emergence. The spray was applied in an apparatus previously described [**29** 591], either directly to the insects or to the substratum, on which they were subsequently confined for five days. Tricoline or thin hardened filter paper was used as the substratum in both tests, in petri dishes in the direct-spray technique. Since small changes in the physical properties of the oil spray gave rise to considerable alterations in the amount of deposit per unit area for the same volumes in the reservoir, deposits per unit area were checked by weighing in the later tests. These were greater on flat disks than in petri dishes for the same volume in the reservoir. No simple relationship was found between the deposit and the physical properties of the oil sprays, but in certain cases there appeared to be a rough correlation with apparent viscosity values. The insects were examined at laboratory temperature, which was somewhat variable, in the early experiments and on a constant-temperature warm plate in later ones, the percentages severely affected or

dead were converted to probits, and the relationships of probits to log concentration of poison or log weight of deposit or of probit planes to both [*cf.* **31** 383] were expressed on graphs.

Direct spraying was compared with the film technique, in experiments in which both concentration and weight of deposit were varied. The substratum was a textile fabric. For both methods, an increase in concentration was more effective than an equivalent increase in deposit. The film technique gave slightly lower kills, but the differences were not significant. The probit planes showed no evidence of a significant difference in homogeneity in a series of tests in which the data were homogeneous, but in one in which some heterogeneity occurred, the data for direct spraying were slightly the less heterogeneous ; there was nothing, however, to show that one technique is significantly better than the other in this respect.

Chemical analysis and direct-spray tests gave similar results for the loss of pyrethrin activity in a pyrethrum and gum tragacanth concentrate dispersed in water and a pyrethrum concentrate in kerosene after exposure to temperatures of 50°C. [122°F.] and 48–58°C. [118·4–136·4°F.], respectively, for 14 days ; it was possible to distinguish with certainty a loss of activity of 10 per cent., as compared with materials kept at 0°C. [32°F.], over the range of concentrations tested by the biological method ; smaller differences were not investigated. A number of tests were carried out by the film technique. On filter paper, increasing the deposit had a greater effect on kill than increasing the concentration, whereas on Tricoline (as in the comparison with direct spraying), the reverse was the case. The presence of sludge (oil-insoluble semi-solid matter) in the spray had no great effect on the weight of deposit or toxicity, but may interfere with the application of the spray by clogging the atomising apparatus and so introduce heterogeneity into the results. Comparison of three standard preparations of pyrethrum in oil, brief specifications for which are given, with one another and with commercial pyrethrum insecticides by the film technique to determine the effect on toxicity of the method of preparation, the percentage of soluble resin and the presence of an antioxidant showed that, apart from the oil, only the pyrethrins had a measurable effect on toxicity. The biological assessment agreed well with the results of chemical analysis, but correlation was closer for the percentage of total pyrethrins than for pyrethrin I, indicating the importance of finding a satisfactory method of determining pyrethrin II.

Parkin (E. A.) & Green (A. A.). **A film Technique for the biological Evaluation of Pyrethrum-in-Oil Insecticides for Use against Stored Product Insects in Warehouses.**—*Ann. appl. Biol.* **30** no. 3 pp. 279–292, 5 figs., 13 refs. London, 1943.

The development of a film technique by which pyrethrum sprays may be compared with a tentative standard containing 0·8 per cent. (w/v) pyrethrin I in heavy white oil by biological methods, with *Tribolium castaneum*, Hbst., as the test insect [*cf. R.A.E.*, A **31** 85], is described in some detail. This technique, which was devised for evaluating insecticides with a high concentration of toxic principle (1·6 per cent. total pyrethrins) in a non-volatile oil of high viscosity, is compared with the Peet-Grady method for relating the effect on *Musca domestica*, L., of preparations of low pyrethrin content in volatile oils of low viscosity with that of a standard pyrethrum preparation in a refined kerosene oil. The Peet-Grady method is based on the replication of a fixed dose of spray, chosen so that the standard preparation causes a mortality of 30–55 per cent. among flies of suitable resistance. The technique described in this paper involves the computation of regression lines by a method of statistical analysis requiring the use of a calculating machine, but within limits, a comparison of the toxicity of two insecticides can be made by visual appraisal

of the extent of overlapping of the transformed dosage-mortality data, when plotted graphically for drawing the provisional regression lines, and the technique could be simplified to one similar to the Peet-Grady method, *viz.*, replication for all materials of a deposit giving about 50 per cent. kill with the standard solution and comparison of the mean mortalities in batches of beetles after exposure. Comparison of mortalities at a fixed dose is valid, however, only if the regression lines are approximately parallel, and until information is available on the slopes of regression lines representing the effects of insecticides containing pyrethrum or other toxic substances or mixtures of pyrethrum with other toxic substances, the reduction of the technique to a simpler form for general use is not advisable.

MARTIN (J. T.). **The Preparation of a standard Pyrethrum Extract in heavy Mineral Oil, with Observations on the relative Toxicities of the Pyrethrins in Oil and aqueous Media.**—*Ann. appl. Biol.* **30** no. 3 pp. 293–300, 1 fig., 21 refs. London, 1943.

The author gives a detailed description of the development and method of preparation of a standard extract of pyrethrum in highly refined heavy mineral oil, suitable for use as a basis of reference in the biological evaluation of commercial preparations of pyrethrum and heavy oil [*cf.* *R.A.E.*, A **31** 85]. The solution was standardised with respect to colour, resin content and equal proportions of the pyrethrins, and when it contained pyrocatechol in ether, remained stable, as judged by chemical determination of the pyrethrins, for several months. Concentrates in which the ratios of pyrethrin I to pyrethrin II were 1·75 : 1 and 0·27 : 1, and mixtures of the two were dissolved in and diluted with heavy mineral oil or dissolved in alcohol and diluted with water containing 0·5 per cent. saponin and compared by spraying adults of *Tribolium castaneum*, Hbst., on Tricoline. The beetles were examined three days after application of the oil sprays and two days after application of the water sprays. Statistical analysis of the results showed that in the heavy mineral oil, the toxicity of pyrethrin II closely approaches that of pyrethrin I, the difference in toxicity between the two concentrates being insufficient to show any possible synergistic or antagonistic effect in the mixture, whereas in the aqueous medium, pyrethrin II is many times less toxic than pyrethrin I, and the mixture showed synergism between the components in one of two tests and slight, non-significant antagonism in the other. It is considered, therefore, that whereas pyrethrin I alone is likely to indicate the relative toxicities of extracts of pyrethrum flowers in an aqueous medium, the contents of both pyrethrins need to be taken into account in the assessment of standard insecticide and commercial pyrethrum preparations in heavy mineral oil solution. The median lethal concentrations of the pyrethrin I and II concentrates in oil were both about 2,455 mg. per litre when the spray deposit was 0·7 mg. per sq. cm., and those in water were 99 and 266 mg. per litre, respectively, when the deposit was approximately 9 mg. per sq. cm. Since it is calculated that 0·002 mg. total pyrethrins per sq. cm. was deposited by the pyrethrin concentrates in the oil sprays and 0·0009 and 0·0024 mg. per sq. cm. by the pyrethrin I and II concentrates, respectively, in the aqueous sprays, at the 50 per cent. mortality level, it is concluded that the pyrethrin I concentrate in water is more efficient than either concentrate in oil, but that these are slightly more efficient than the pyrethrin II concentrate in water.

Proprietary Products for the Control of Plant Pests and Diseases. Scheme for official Approval.—*Agriculture* **50** no. 7 pp. 331–334, 1 fig., 2 refs. London, 1943.

A description is given of the main features of a scheme under which manufacturers of proprietary insecticides and fungicides marketed in Great Britain

may voluntarily submit their products for official approval to an advisory committee of specialists, nominated by the Minister of Agriculture and the Secretary of State for Scotland in consultation with the Agricultural Research Council. Approval may be sought for products guaranteed to comply with an agreed specification or for products for which no official specification is at present available but of which the chief active ingredients are declared or are not regarded as secret by the makers. Each container of an approved product will bear the brand name of the article and an approval mark, and lists of the products, suitably classified according to their composition and use, will be issued periodically. The first of these lists appeared in February 1944.

Ellis (E. A.). **Flora and Fauna of Norfolk . . . Insects.**—*Trans. Norfolk Norw. Nat. Soc.* **15** (1943) pt. 5 pp. 429–438. Norwich, 1944.

Brief notes are given on various insects observed in Norfolk in 1942–43. They include *Prionus coriarius*, L., the larvae of which were found boring in telephone poles, and *Criocephalus ferus*, Muls. (*polonicus*, Motsch.), a female of which, probably introduced in pinewood from abroad, was found in a floor board.

Papers noticed by Title only.

Nixon (G. E. J.). **A Revision of the Spathiinae of the Old World (Hymenoptera, Braconidae).**—*Trans. R. ent. Soc. Lond.* **93** pt. 2 pp. 173–456, 283 figs., 32 refs. London, 1943.

Rees (B. E.). **Classification of the Dermestidae (Larder, Hide and Carpet Beetles) based on larval Characters, with a Key to the North American Genera.**—*Misc. Publ. U.S. Dep. Agric.* no. 511, 18 pp., 5 figs., 11 refs. Washington, D.C., 1943.

Lubatti (O. F.). **Determination of Fumigants. I. Residual Hydrogen Cyanide in Stored Products (Cacao, Wheat, Tobacco, etc.).**—*J. Soc. chem. Ind.* **54** no. 34 pp. 275T–282T, 2 figs., 3 graphs. London, 1935.

Page (A. B. P.). **II. An Improved Vacuum Apparatus for the Measurement of Gas Concentrations.**—*T.c.* no. 50 pp. 421T–424T, 2 figs.

Lubatti (O. F.). **III. Microdetermination of Ethylene Oxide and Hydrogen Cyanide.**—*T.c.* no. 50 pp. 424T–426T, 1 fig.

Page (A. B. P.) & Gloyns (F. P.). **IV. Detection and Determination of Residues of Hydrogen Cyanide. V. Determination of Hydrogen Cyanide evolved from Discs of Wood Pulp.**—*Op. cit.* **55** no. 31 pp. 209T–213T, 1 fig., 1 graph, pp. 213T–217T, 1 fig., 1 graph. 1936.

Brown (W. B.). **VI. Purity of commercial Ethylene Oxide in Cylinders.**—*T.c.* no. 45 pp. 321T–325T, 4 figs.

Lubatti (O. F.). **VII. Determination of Sulphur Dioxide and Sulphur Trioxide from burning Sulphur.**—*T.c.* no. 49 pp. 344T–346T.

Page (A. B. P.) & Lubatti (O. F.). **VIII. Sampling from small Spaces.**—*Op. cit.* **56** pp. 54T–61T, 1 fig., 8 graphs. 1937. [Recd. 1944.] [For Nos. IX & X see *R.A.E.*, B **31** 144 and XI–XIII *R.A.E.*, A **32** 144.]

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